10-3930-628-34

TM 10-3930-628-34

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

TECHNICAL MANUAL

DIRECT AND GENERAL SUPPORT

MAINTENANCE MANUAL

TRUCK, LIFT, FORK, EMD, SOLID RUBBER

TIRED WHEELS, 2000 LB CAPACITY, 144 IN LIFT

ARMY MODEL MHE-219

ALLIS CHALMERS MODEL FE20-24EE

FSN 3930-151-4432

This copy is a reprint which includes current pages from Changes 1 and 2.

HEADQUARTERS, DEPARTMENT OF THE ARMY

DECEMBER 1971

C 101.11:

READEX FICHE best copy available

WARNING

When servicing the battery, do not smoke or use a flame in the vicinity. Batteries generate hydrogen, a highly explosive gas.

Always correct or report any faulty conditions that may result in further damage to the truck or cause injury to personnel.

Check the operating area to be sure that it is clear of personnel and obstructions.

Do not shift the forward and reverse control lever while the truck is in motion.

Do not operate the truck with the load in a highly elevated position.

When operating the truck, the mast should be tilted backwards slightly to prevent the load from falling off.

Make sure that the forks are lowered to the ground when the truck is parked. Check seat controlled brake for proper operation and engagement.

If the truck is parked on an incline, block at least two wheels to prevent the truck from moving in the event of a parking brake failure.

Report or correct any faulty conditions that may result in damage to the truck or cause injury to personnel if operation of the truck is continued.

Do not store or recharge nickle / iron batteries and lead acid batteries in the same room. Do not mix hydrometers or battery acids (potassium hydroxide and sulfuric) in the process of servicing and / or repairing nickel / iron and lead acid batteries.

Changes in Force: C 1 and C 2

TM 10-3930-628-34
C 2

CHANGE
No. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *27 March 1974*

Direct Support and General Support Maintenance Manual
TRUCK, LIFT, FORK, EMD, SOLID RUBBER TIRED WHEELS, 2000 LB. CAPACITY, 144 IN. LIFT
ARMY MODEL MHE 219
ALLIS CHALMERS MODEL FE20-24EE
ALLIS CHALMERS MODEL ACE20-24EE
FSN 3930-151-4432

TM 10-3930-628-34, 2 December 1971 is changed as follows:

The title is changed as shown above.

Page iii a List of Illustrations are added in numerical sequence as follows:

1-1.1. Schematic wiring diagram, fork lift truck, model ACE 20-24EE
3-1.1. Hydraulic lift system, schematic, model ACE20-24EE
3-11.1. Hydraulic oil reservoir, exploded view, model ACE20-24EE

Page 1-1. paragraph 1-3 is superseded as follows:

1-3. Recommendation for Maintenance Publication Improvements

The reporting of errors, omissions and recommendations for improving this publication by you, the individual user, is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to DA Publications and Blank Forms) and forwarded direct to Commander, U.S. Army Troop Support Command, ATTN: AMSTS-MPP, 4300 Goodfellow Boulevard, St. Louis, MO 63120. A reply will be furnished directly to you.

Page 1-1 paragraph 1-5, subparagraph *h* is superseded as follows:

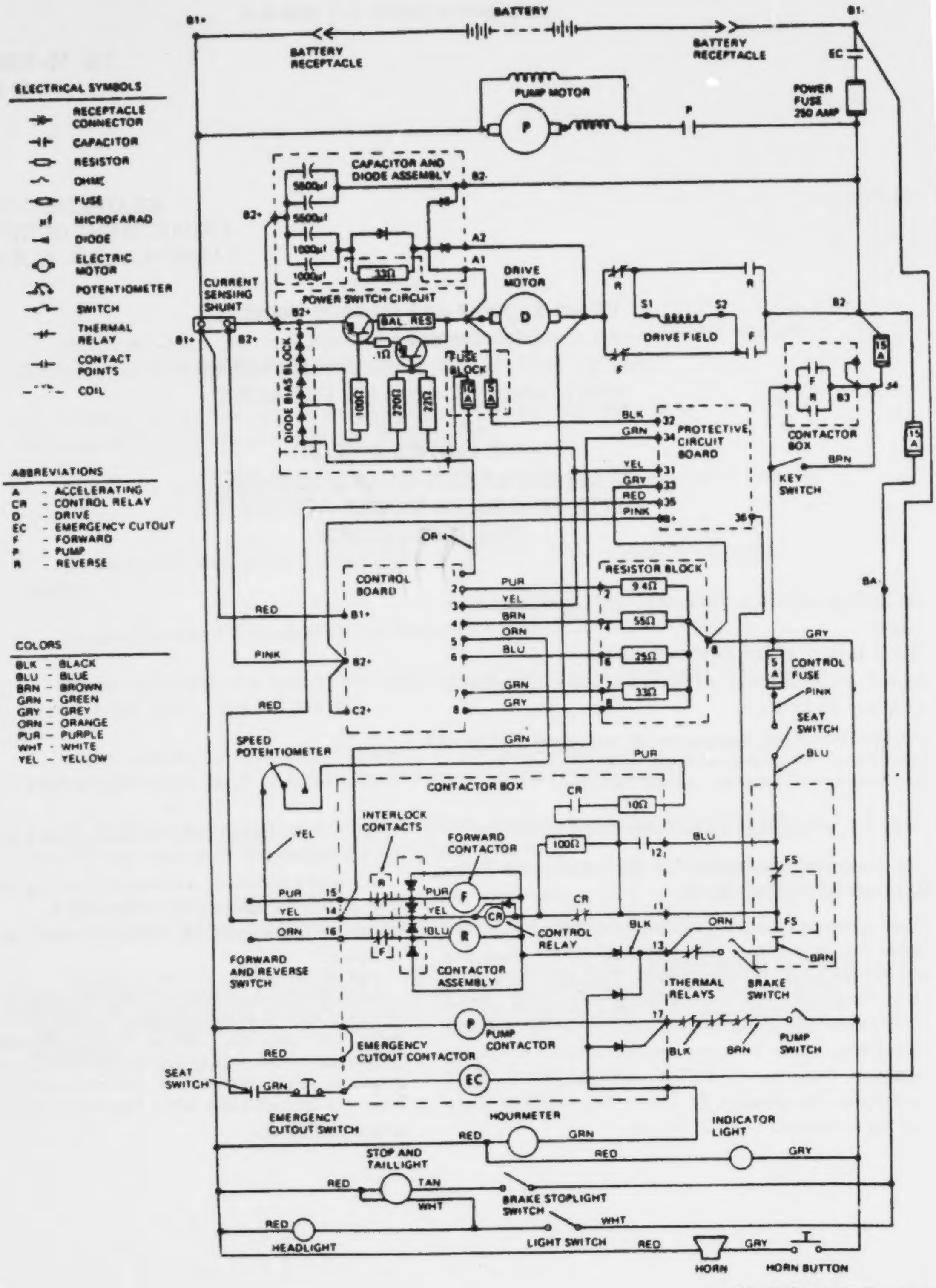
h Figure 1-1 shows a schematic wiring diagram for the fork lift truck, model FE20-24EE.

Page 1-1 paragraph 1-5, subparagraph *i* is added as follows:

i Figure 1-1.1 shows a schematic wiring diagram for the fork lift truck, model ACE20-24EE.

Page 1-2 caption, figure 1-1 is changed from schematic wiring diagram for lift truck to "*Figure 1-1. Schematic wiring diagram fork lift truck, model FE20-24EE.*"

Page 1-2 immediately after figure 1-1, figure 1-1.1 is added as follows:


ELECTRICAL SYMBOLS
RECEPTACLE CONNECTOR
CAPACITOR
RESISTOR
OHMS
FUSE
μf MICROFARAD
DIODE
ELECTRIC MOTOR
POTENTIOMETER
SWITCH
THERMAL RELAY
CONTACT POINTS
COIL
ABBREVIATIONS
A - ACCELERATING
CR - CONTROL RELAY
D - DRIVE
EC - EMERGENCY CUTOUT
F - FORWARD
P - PUMP
R - REVERSE
COLORS
BLK - BLACK
BLU - BLUE
BRN - BROWN
GRN - GREEN
GRY - GREY
ORN - ORANGE
PUR - PURPLE
WHT - WHITE
YEL - YELLOW
B1+
BATTERY
B1-
BATTERY RECEPTACLE
BATTERY RECEPTACLE
EC
PUMP MOTOR
P
POWER FUSE 250 AMP
CAPACITOR AND DIODE ASSEMBLY
5600μf
5600μf
1000μf
1000μf
33Ω
B2-
B2+
A2
A1
DRIVE MOTOR
D
CURRENT SENSING SHUNT
POWER SWITCH CIRCUIT
BAL RES
.1Ω
100Ω
220Ω
22Ω
DIODE BIAS BLOCK
FUSE BLOCK
10 A
5 A
B2+
R
R
S1
S2
DRIVE FIELD
F
F
B2
15 A
CONTACTOR BOX
F
R
B3
J4
BLK
GRN
32
34
PROTECTIVE CIRCUIT BOARD
YEL
GRY
RED
PINK
31
33
35
36
KEY SWITCH
BRN
15 A
OR
CONTROL BOARD
RED
B1+
PINK
B2+
RED
C2+
PUR
YEL
BRN
ORN
BLU
GRN
GRY
RESISTOR BLOCK
9.4Ω
55Ω
29Ω
33Ω
BA
GRY
5 A
CONTROL FUSE
PINK
SEAT SWITCH
BLU
GRN
PUR
SPEED POTENTIOMETER
CONTACTOR BOX
CR
10Ω
INTERLOCK CONTACTS
FORWARD CONTACTOR
100Ω
12
BLU
FS
FS
YEL
PUR
YEL
ORN
15
14
16
F
R
CR
CR
11
CONTROL RELAY
BLK
ORN
13
BRN
FORWARD AND REVERSE SWITCH
CONTACTOR ASSEMBLY
THERMAL RELAYS
BRAKE SWITCH
17
P
PUMP CONTACTOR
BLK
BRN
PUMP SWITCH
EMERGENCY CUTOUT CONTACTOR
RED
SEAT SWITCH
GRN
EC
EMERGENCY CUTOUT SWITCH
HOURMETER
RED
GRN
INDICATOR LIGHT
RED
GRY
STOP AND TAILLIGHT
RED
TAN
WHT
BRAKE STOPLIGHT SWITCH
WHT
RED
HEADLIGHT
LIGHT SWITCH
RED
HORN
GRY
HORN BUTTON

ME 3930-628-34/1-1.1 C2

Figure 1-1.1 Schematic Wiring Diagram, Fork Lift Truck Model ACE20-24EE.

Page 2-3, table 2-1. In *corrective action* column of line 18*c*, "(para 3-46)" is changed to read "(para 3-49)". Paragraph 2-5*a*(4) is superseded as follows:

(4). Remove the elbow (66, fig. 3-3) from the flow regulator body (64). Remove regulator body (64) from cylinder (15).

Page 3-11, paragraph 3-14*c*. In subparagraph (9), "elbow (66) and connector (67)" is changed to read "elbow (66)".

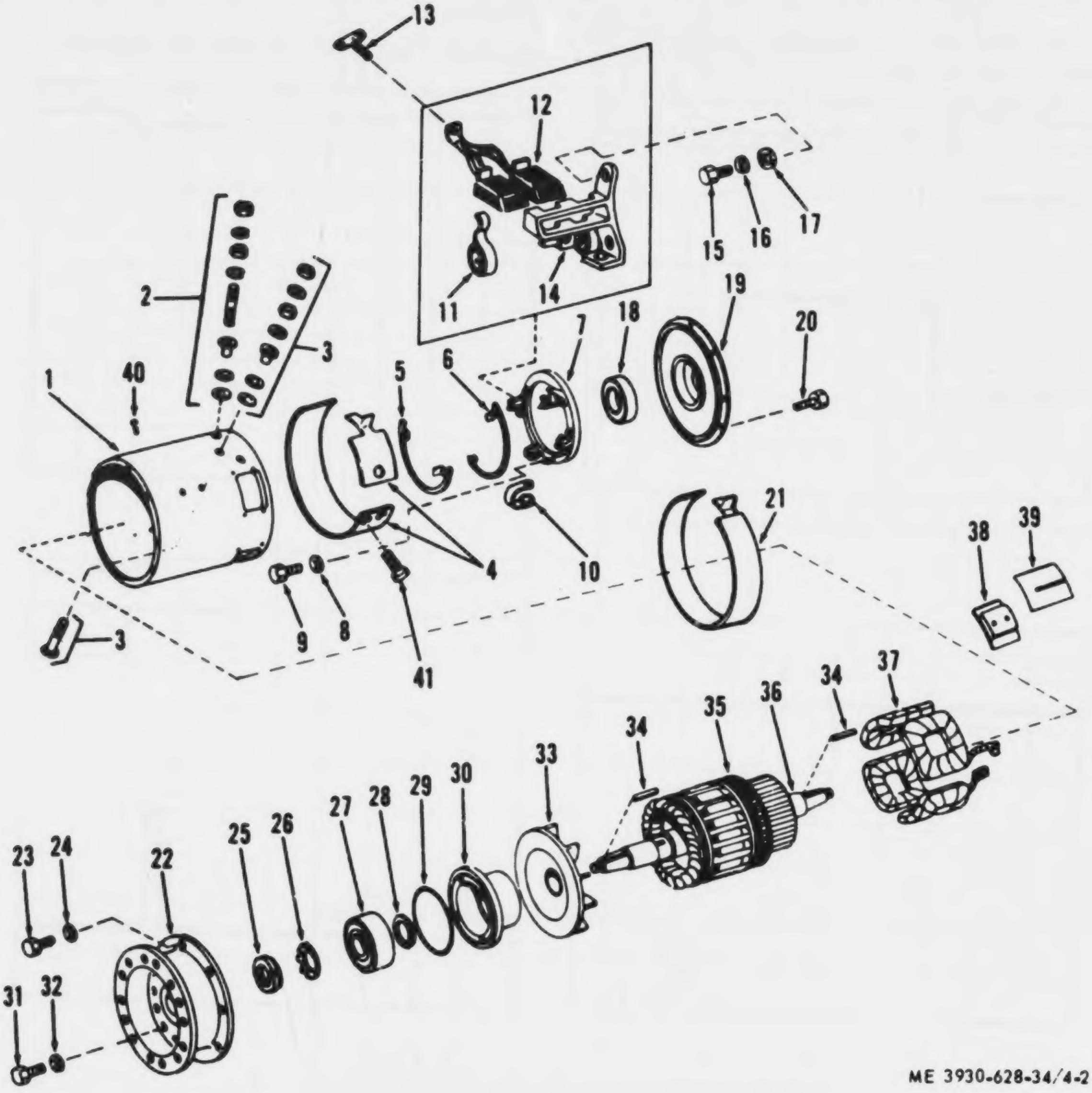
Page 3-25, paragraph 3-44. In subparagraph *b*, "center cover panel" is changed to read "right cover panel".

Page 3-33, key to figure 3-18. Item "22. Hydraulic control valve assembly" is added after item 21.

Page 4-2. Paragraph 4-3*b* is superseded as follows:

b. Remove rear band retaining screws (41, fig. 4-2) and remove rear band assembly (4).

Figure 4-2 is superseded as follows:



ME 3930-628-34/4-2 C1

Figure 4-2. Drive motor, exploded view.

In legend to figure 4-2, item "41 Screw" is added after item 40.

Page 4-8, paragraph 4-6*a*(1) is superseded as follows:

(1). Remove rear band retaining screws (41, fig. 4-2) and remove rear band assembly (4) from around the field yoke (1).

Page 4-10, paragraph 4-7*h*. In the third sentence, "screws (23)" is changed to read "screws (23, fig. 4-2)".

Paragraph 4-7i. In the second sentence, "the yoke (1)" is changed to read "the yoke (1), and secure in place with screws (41)".

Page 4-29, table 4-2. In *Connections* column of test numbers 1, 2, and 3" (fig. 4-29)" is changed to read "(fig. 4-27)". In *Connections* column of test numbers 4 and 5, "(fig. 4-31)" is changed to read "(fig. 4-29)".

Page 4-30, table 4-2. In *Connections* column of test numbers 6 and 7, "(fig. 4-31)" is changed to read "(fig. 4-29)". In *Connections* column of test numbers 8, 9, 10a, 10b and 11, "(fig. 4-33)" is changed to read "(fig. 4-31)". In *Connections* column of test numbers 12 and 13, "(fig. 4-35)" is changed to read "(fig. 4-33)".

Page 4-31, table 4-2. In *Connections* column of test numbers 14 and 15, "(fig. 4-35)" is changed to read "(fig. 4-33)". In *Connections* column of test numbers 16, 17, 18a and 18b, "(fig. 4-37)" is changed to read "(fig. 4-35)".

Page 4-35. Figure 4-30 is superseded as follows:

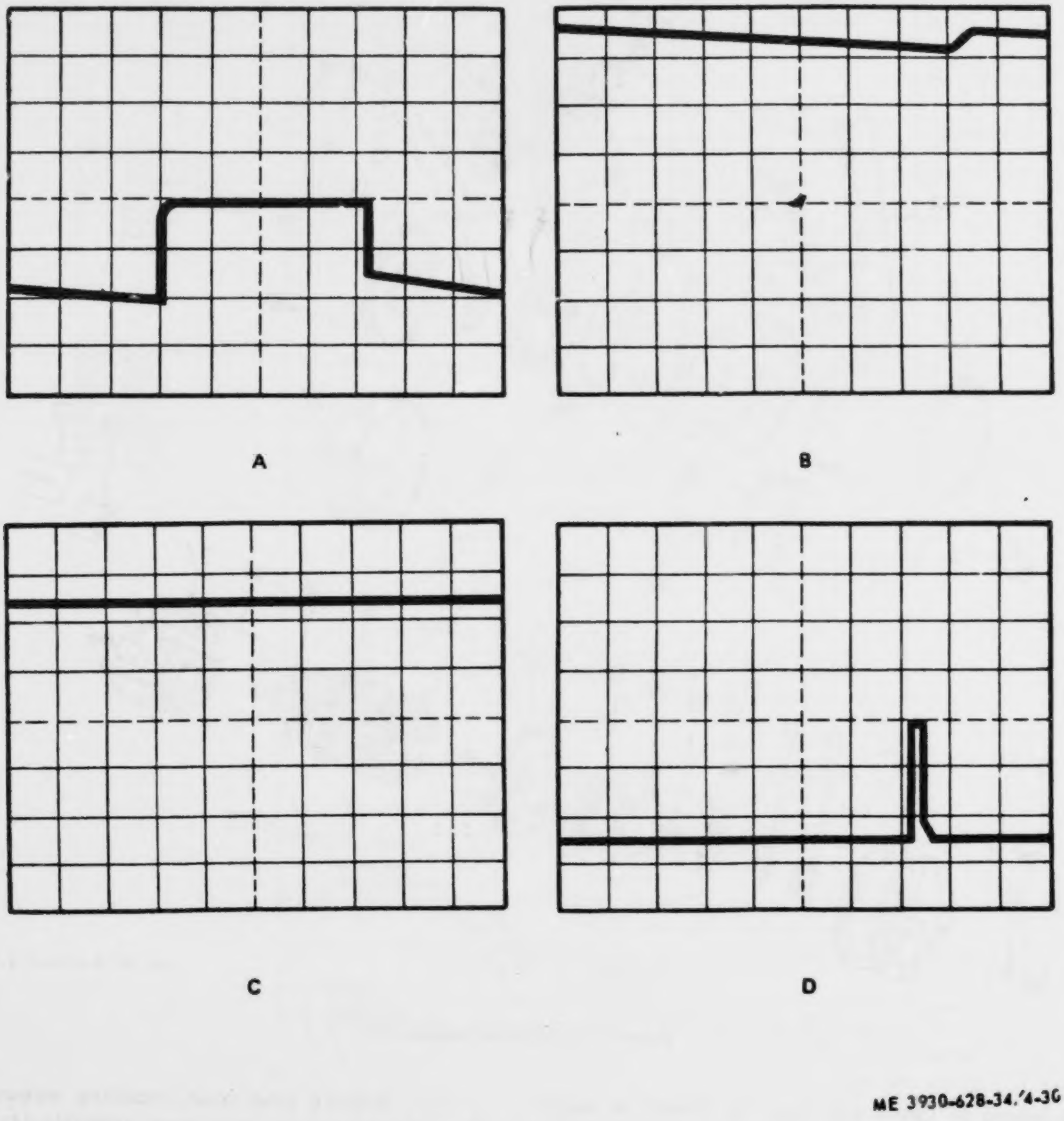
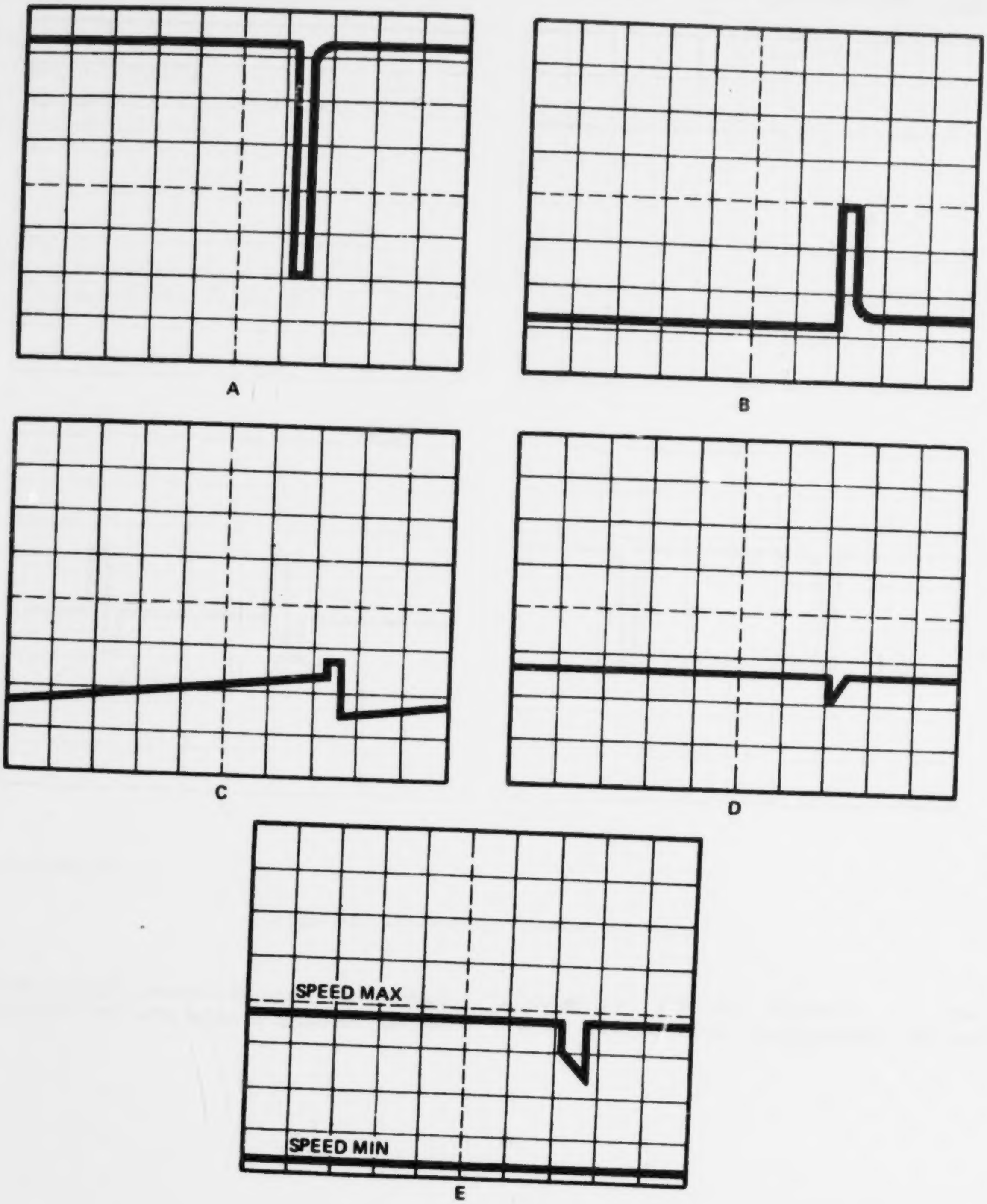


Figure 4-30. Oscilloscope waveshapes (tests 4 through 7).

Page 4-37. **Figure 4-32 is superseded as follows:**


A
B
C
D
SPEED MAX
SPEED MIN
E

ME 3930-628-34/4-32 C1

Figure 4-32. Oscilloscope waveshapes (tests 8 through 11).

Page 4-41. Figure 4-36 is superseded as follows:

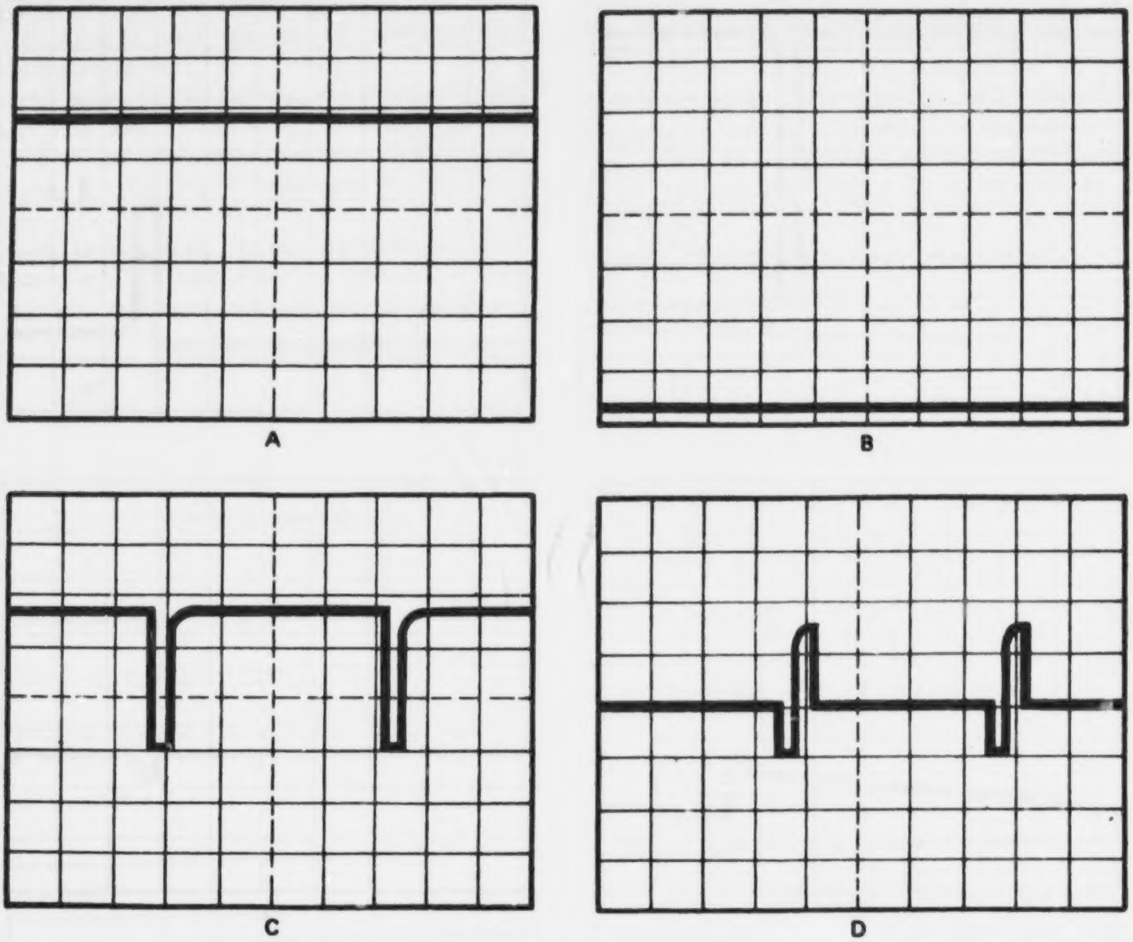


Figure 4-36. Oscilloscope waveshapes (tests 16 through 18).

Page A-1, paragraph A-5. TM 11-6140-203-15, Operator, Organizational, Direct Support, General Support, and Depot Maintenance Manual, Battery, Storage, BB-432/A is added after TM 9-6140-200-15.

By order of the Secretary of the Army:

CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

Official:

VERNE L. BOWERS,
Major General, United States Army,
The Adjutant General.

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Change No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D. C. *28 November 1972*

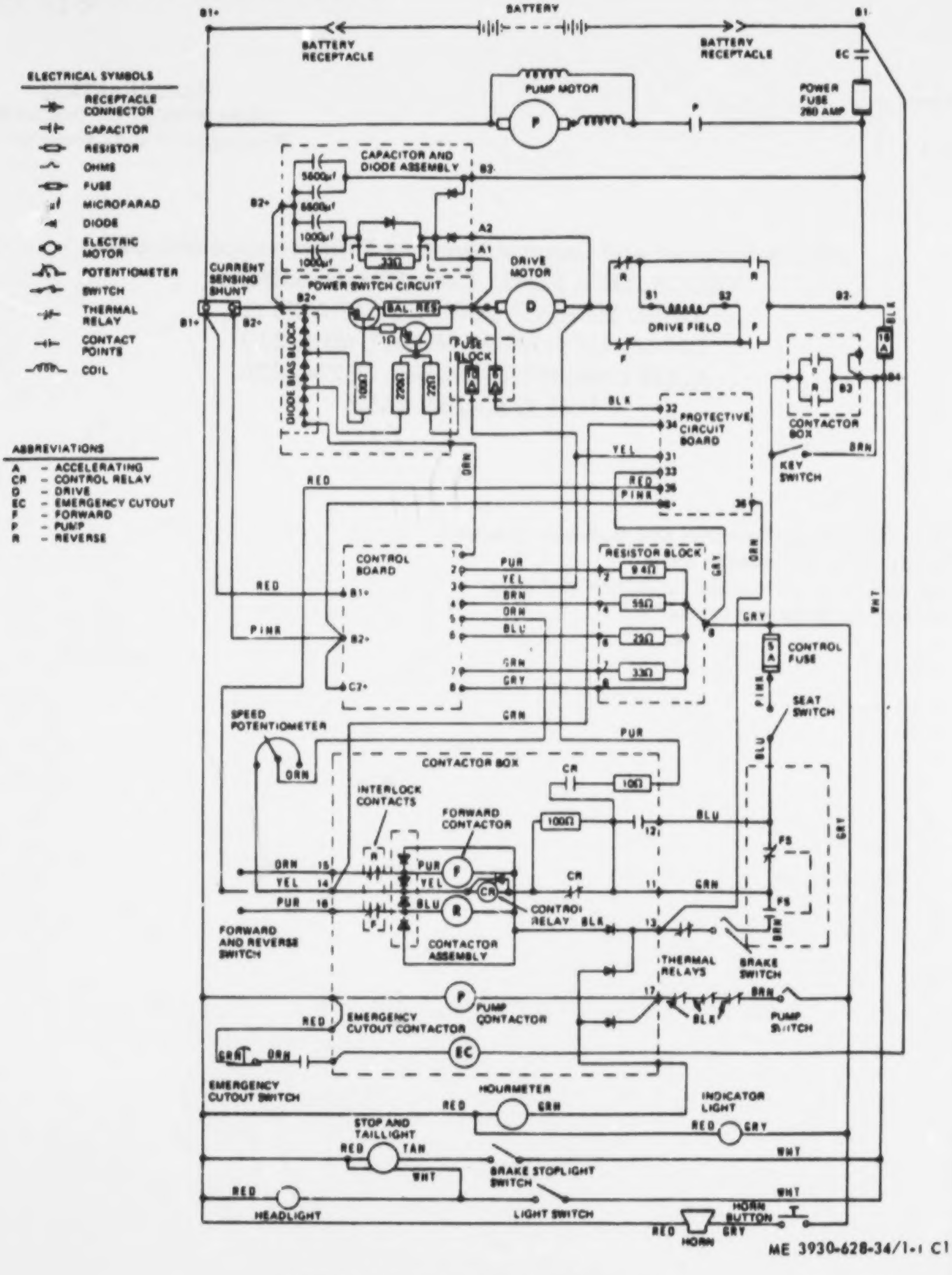
Direct Support and General Support Maintenance Manual
TRUCK, LIFT, FORK, EMD, SOLID RUBBER TIRED WHEELS, 2000-LB CAPACITY, 144-IN. LIFT, ARMY MODEL MHE-219
ALLIS CHALMERS MODEL FE20-24EE
FSN 3930-151-4432

TM 10-3930-628-34, 2 December 1971, is changed as follows:

The title is changed as shown above.

Page iii, List of Illustrations. In caption of illustrations 1-1, "for" is changed to read "fork".

Page 1-2. **Figure 1-1 is superseded as follows:**


ELECTRICAL SYMBOLS
RECEPTACLE CONNECTOR
CAPACITOR
RESISTOR
OHMS
FUSE
MICROFARAD
DIODE
ELECTRIC MOTOR
POTENTIOMETER
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THERMAL RELAY
CONTACT POINTS
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ABBREVIATIONS
A - ACCELERATING
CR - CONTROL RELAY
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BATTERY
B1+
B1-
BATTERY RECEPTACLE
BATTERY RECEPTACLE
EC
PUMP MOTOR
P
POWER FUSE 250 AMP
CAPACITOR AND DIODE ASSEMBLY
5600μf
5600μf
1000μf
1000μf
33Ω
B2+
B2-
A2
A1
CURRENT SENSING SHUNT
POWER SWITCH CIRCUIT
BAL RES
1Ω
100Ω
2200Ω
22Ω
DIODE BIAS BLOCK
FUSE BLOCK
DRIVE MOTOR
D
R
S1
S2
DRIVE FIELD
F
BLK
CONTACTOR BOX
KEY SWITCH
PROTECTIVE CIRCUIT BOARD
32
34
31
33
35
36
YEL
RED
PINK
GRN
BRN
CONTROL BOARD
B1+
B2+
C7+
PUR
BLU
GRY
ORN
RESISTOR BLOCK
9.4Ω
56Ω
25Ω
33Ω
CONTROL FUSE
WHT
SEAT SWITCH
SPEED POTENTIOMETER
CONTACTOR BOX
CR
10Ω
100Ω
INTERLOCK CONTACTS
FORWARD CONTACTOR
CONTROL RELAY
CONTACTOR ASSEMBLY
FORWARD AND REVERSE SWITCH
15
14
16
12
11
13
17
FS
THERMAL RELAYS
BRAKE SWITCH
PUMP CONTACTOR
PUMP SWITCH
EMERGENCY CUTOUT CONTACTOR
EMERGENCY CUTOUT SWITCH
HOURMETER
INDICATOR LIGHT
STOP AND TAILLIGHT
TAN
BRAKE STOPLIGHT SWITCH
HEADLIGHT
LIGHT SWITCH
HORN
HORN BUTTON
ME 3930-628-34/1-1 C1

Figure 1-1. Schematic wiring diagram, forklift truck.

Page 3-2 caption, figure 3-1 is changed from Hydraulic Lift System Schematic to "*Figure 3-1, Hydraulic Lift System Schematic, Model FE20-24EE*".

Page 3-2 immediately after Figure 3-1, Figure 3-1.1 is added as follows:

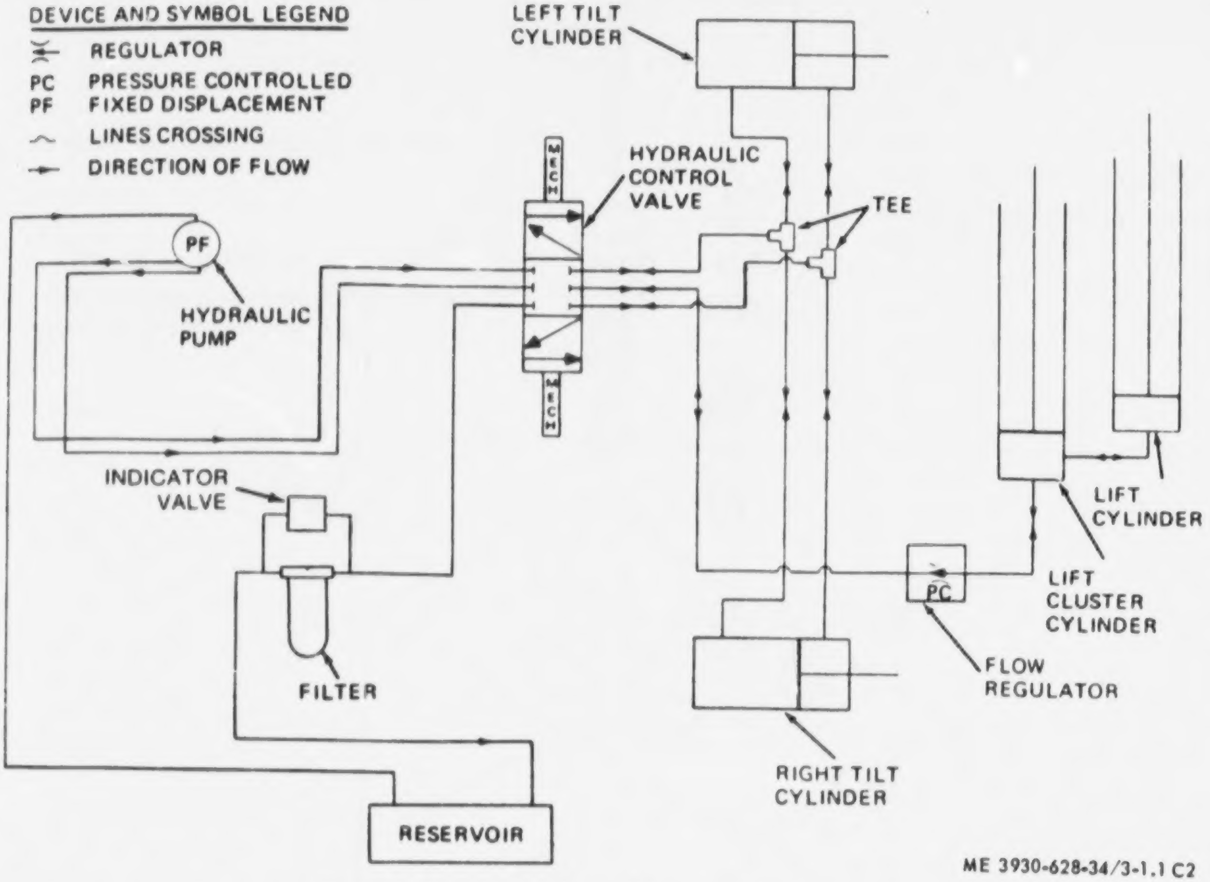

DEVICE AND SYMBOL LEGEND
REGULATOR
PC PRESSURE CONTROLLED
PF FIXED DISPLACEMENT
LINES CROSSING
DIRECTION OF FLOW
LEFT TILT CYLINDER
HYDRAULIC CONTROL VALVE
MECH
TEE
PF
HYDRAULIC PUMP
MECH
LIFT CYLINDER
LIFT CLUSTER CYLINDER
INDICATOR VALVE
PC
FILTER
FLOW REGULATOR
RIGHT TILT CYLINDER
RESERVOIR
ME 3930-628-34/3-1.1 C2

Figure 3-1.1. Hydraulic Lift System Schematic, Model ACE20-24EE.

Page 3-19 paragraph 3-33, subparagraph *i* is added as follows:

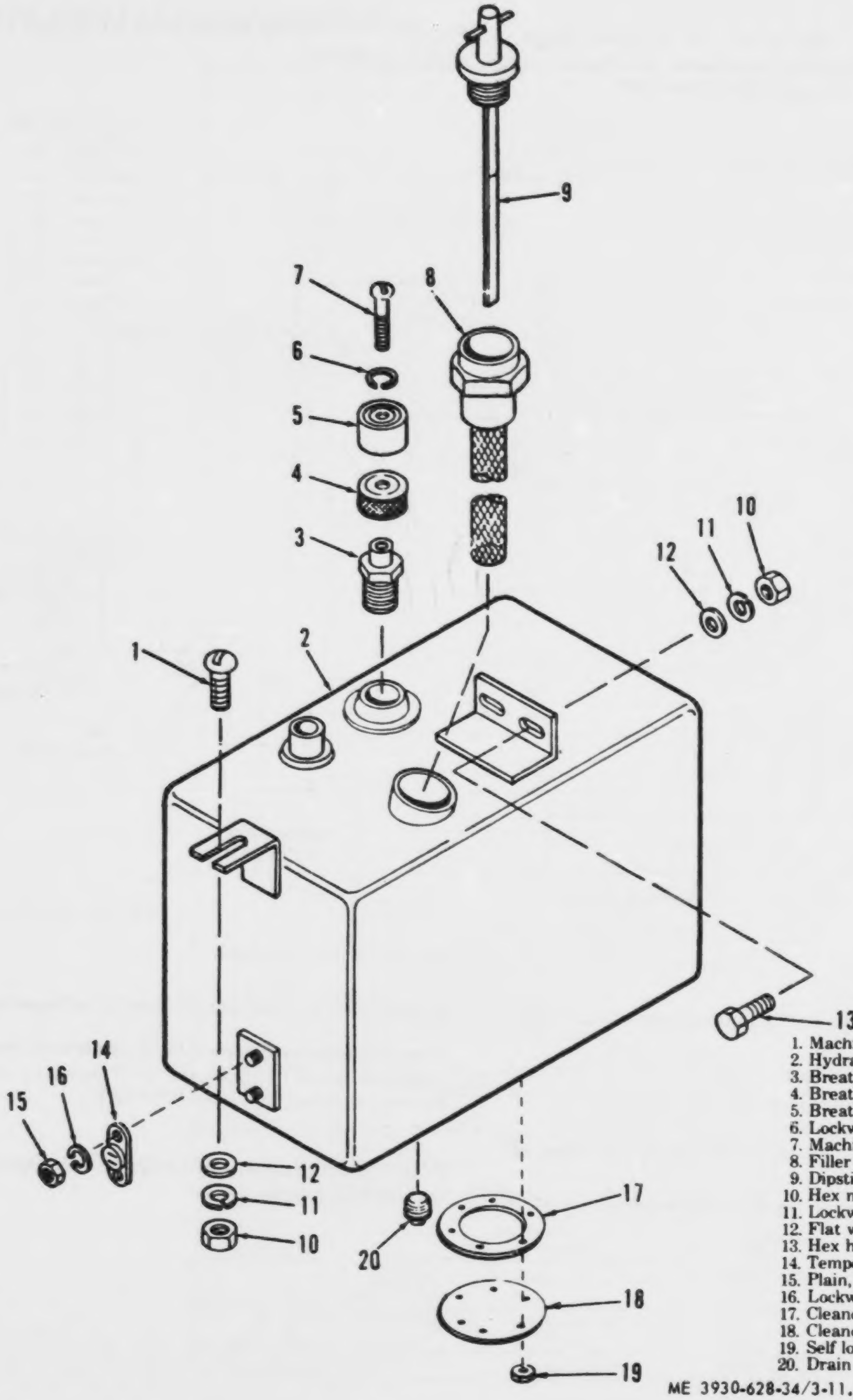
i Remove six locking nuts (19, fig. 3-11.1), cleanout cover (18) and cover gasket (17) from bottom of reservoir (2).

Page 3-19 paragraph 3-33, subparagraph *j* is added as follows:

j Remove screw (7, fig. 3-11.1) washer (6) cover (5) element (4) and breather (3) from top of reservior (2).

Page 3-20 caption, figure 3-11, Hydraulic oil reservoir exploded view, is changed to "*Figure 3-11, Hydraulic Reservoir, Exploded View, Model FE20-24EE*".

Page 3-30 immediately after figure 3-11, figure 3-11.1 is added as follows:


9
7
8
6
5
4
3
10
11
12
1
2
13
14
16
15
12
11
10
17
20
18
19
ME 3930-628-34/3-11.1 C2

1. Machine screw
2. Hydraulic reservoir
3. Breather
4. Breather element
5. Breather cover
6. Lockwasher
7. Machine screw
8. Filler screen
9. Dipstick
10. Hex nut
11. Lockwasher
12. Flat washer
13. Hex head screw
14. Temperature sending unit
15. Plain, hex nut
16. Lockwasher
17. Cleanout cover gasket
18. Cleanout cover
19. Self locking nut
20. Drain plug

Figure 3-11.1. Hydraulic Oil Reservoir, Exploded View, Model ACE20-24EE.

Page 3-21 paragraph 3-36 subparagraph *a* is superseded as follows:

a Refer to figure 3-10, 3-11 and 3-11.1 and install the reservoir as follows:

Page 3-21 paragraph 3-36, subparagraph *c* is superseded as follows:

c Install Drain Plug (20, figure 3-11.1), install Gasket (17), Cover (18) and secure with six self locking nuts (19).

By Order of the Secretary of the Army:

CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

Official:
VERNE L. BOWERS
Major General, United States Army
The Adjutant General

Distribution:
To be distributed in accordance with DA Form 12-25A, (qty rqr block no. 895) Direct and General Support maintenance requirements for Warehouse.

TECHNICAL MANUAL
NO. 10-3930-628-34

HEADQUARTERS,
DEPARTMENT OF ARMY
WASHINGTON, D. C., *2 December 1971*

DIRECT AND GENERAL SUPPORT MAINTENANCE MANUAL

TRUCK, LIFT, FORK, EMD, SOLID RUBBER TIRED WHEELS, 2000 LBS. CAPACITY, 144 IN. LIFT

ALLIS CHALMERS MODEL FE20-24EE, FSN 3930-151-4432

ARMY MODEL MHE-219

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

This manual contains the information necessary for the maintenance of the Truck, Lift, Fork, Electric, Solid Rubber Tired Wheels, 2000 pound capacity by Direct Support and General Support Maintenance personnel as allocated by the Maintenance Allocation Chart. The manual provides information on the maintenance of the equipment which is beyond the scope of the tools, equipment, personnel, or supplies normally available to Operator and Organizational Maintenance.

1-2. Forms and Records

DA forms and records used for equipment maintenance will be only those prescribed in TM 38-750.

1-3. Reporting of Errors

Report of errors, omissions, and recommendations for improvement of this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications) and forwarded direct to Commanding General, U.S. Army Mobility Equipment Command, ATTN: AMSME-MPP, 4300 Goodfellow Boulevard, St. Louis, Mo. 63120.

Section II. DESCRIPTION AND DATA

1-4. Description

A general description of the Truck, Fork Lift and information pertaining to the identification plates is contained in TM 10-3930-628-12. A more detailed description of specific components and assemblies is contained in the applicable sections of this manual. Detailed descriptions of the components of the truck are provided in the applicable maintenance paragraphs of this manual.

1-5. Identification and Tabulated Data

a. General. This paragraph contains all of the maintenance data pertinent to direct and general support maintenance personnel.

b. Identification. The lift truck has two identification plates.

(1) *Army data plate.* Located on the instrument panel. Specifies the nomenclature, manufacturer, model and serial numbers and capacity.

(2) *Shipping plate.* Located on front of frame. Specifies shipping dimensions, weight and cubage.

c. Drive Motor Classification and Rating.

Make	Allis Chalmers
Model	725B4
Horsepower	4.6 HP
Current Draw	95 Amps
Voltage	36 Volts
Speed	880 RPM
Winding Type	Series Wound
Cooling	Fan Cooled
Insulation	Class F
Rotation	Clockwise

d. Pump Motor Classification and Rating.

Make	Allis Chalmers
Model	450CS3
Horsepower	11.5 HP
Current Draw	294 Amps
Voltage	36 Volts
Speed	2015 RPM
Winding Type	Series Wound
Cooling	Fan Cooled
Insulation	Class F
Rotation	Counterclockwise

e. Steering Unit Classification and Rating.

Make	Ross Gear
Model	253AA008
Type	Manual

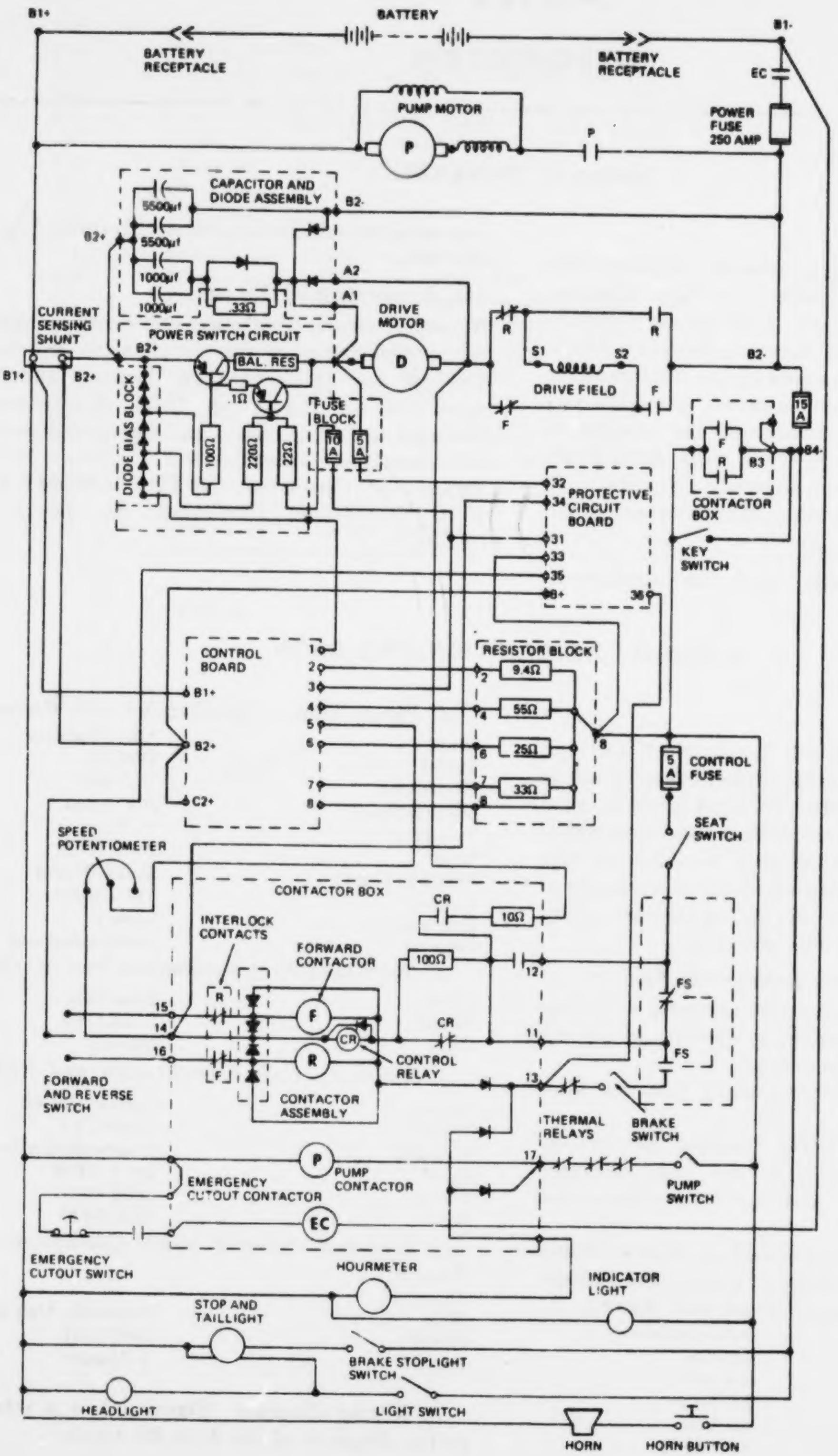
f. Hydraulic Unit Classification and Rating.

Make	Cessna Aircraft
Model	24386LAA
Rotation	Counterclockwise
Speed	2015 RPM
Pressure	1500 PSI
Flow	11.8 GPM

g. Hydraulic Control Valve Classification and Rating.

Make	Hydraulic Unit Specialties
Model	5000-2-31
Control	2 Plunger

h. Wiring Diagram. Figure 1-1 is a schematic wiring diagram of the fork lift truck.


B1+
BATTERY
B1-
BATTERY RECEPTACLE
BATTERY RECEPTACLE
EC
PUMP MOTOR
P
P
POWER FUSE 250 AMP
CAPACITOR AND DIODE ASSEMBLY
5500µf
5500µf
B2-
B2+
1000µf
1000µf
.33Ω
A2
A1
CURRENT SENSING SHUNT
POWER SWITCH CIRCUIT
B2+
DRIVE MOTOR
D
R
R
S1
S2
DRIVE FIELD
F
F
B2-
B1+
B2+
BAL. RES
.1Ω
DIODE BIAS BLOCK
100Ω
220Ω
22Ω
FUSE BLOCK
10 A
5 A
15 A
F
R
B3
B4-
CONTACTOR BOX
32
34
PROTECTIVE CIRCUIT BOARD
31
33
35
B+
36
KEY SWITCH
CONTROL BOARD
B1+
B2+
C2+
1
2
3
4
5
6
7
8
RESISTOR BLOCK
2
9.4Ω
4
55Ω
6
25Ω
7
8
33Ω
8
5 A
CONTROL FUSE
SEAT SWITCH
SPEED POTENTIOMETER
CONTACTOR BOX
CR
10Ω
INTERLOCK CONTACTS
FORWARD CONTACTOR
100Ω
12
FS
R
15
14
F
CR
CR
11
FS
16
F
R
CONTROL RELAY
13
FORWARD AND REVERSE SWITCH
CONTACTOR ASSEMBLY
THERMAL RELAYS
BRAKE SWITCH
P
PUMP CONTACTOR
17
EMERGENCY CUTOUT CONTACTOR
PUMP SWITCH
EC
EMERGENCY CUTOUT SWITCH
HOURMETER
INDICATOR LIGHT
STOP AND TAILLIGHT
BRAKE STOPLIGHT SWITCH
HEADLIGHT
LIGHT SWITCH
HORN
HORN BUTTON

ELECTRICAL SYMBOLS

≫	RECEPTACLE CONNECTOR
⊣⊢	CAPACITOR
▭	RESISTOR
~	OHMS
▭	FUSE
µf	MICROFARAD
⊣	DIODE
○	ELECTRIC MOTOR
⌒	POTENTIOMETER
⌐	SWITCH
⫲	THERMAL RELAY
⊣⊢	CONTACT POINTS
∿	COIL

ABBREVIATIONS

A	– ACCELERATING
CR	– CONTROL RELAY
D	– DRIVE
EC	– EMERGENCY CUTOUT
F	– FORWARD
P	– PUMP
R	– REVERSE

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Figure 1-1. Schematic wiring diagram, for lift truck.

CHAPTER 2

DIRECT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

2-1. Tools and Equipment

There are no tools and equipment issued with or authorized for the Army Model MHE-219 Fork Lift Truck.

2-2. Special Tools and Equipment

There are no special tools and equipment issued with or authorized for the Army Model MHE-219 Fork Lift Truck.

2-3. Maintenance Repair Parts

Repair parts and equipment are listed and illustrated in the repair parts and special tools list covering direct and general support maintenance (TM 10-3930-628-34P) for this equipment.

Section II. TROUBLESHOOTING

2-4. General

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the Army Model MHE-219 Fork Lift Truck and its components. Malfunctions which may occur are listed in table 2-1. Each malfunction stated is followed by a list of probable causes for the trouble. The corrective action recommended is described opposite the probable cause.

Warning: **Do not use or mix hydrometers used in checking nickel / iron and lead acid batteries.**

Table 2-1. Troubleshooting

Malfunction	Probable Cause	Corrective Action
1. Forward and reverse contactors do not pull in when accelerator is depressed.	*a.* Low battery.	*a.* Check specific gravity.
	b. Faulty battery connector.	*b.* Inspect the connector for burned or corroded contacts. Repair or replace as necessary (TM 10-3930-628-12).
	c. Mechanical interference or foreign material preventing operation.	*c.* Examine contactors visually for obstructions. Remove obstruction (para 4-22).
	d. Improperly adjusted or defective accelerator control.	*d.* Adjust speed potentiometer (para 4-21).
	e. Short or defect in contactor coil or circuit.	*e.* Perform mechanical and dynamic switch tests (para 4-24). Replace shorted or defective contactor coil (para 4-22).
	f. Shorted or defective emergency cutout coil in contactor.	*f.* Perform tests on emergency cutout contactor (para 4-24). Replace defective contact coil (para 4-22).
2. Contactors pull in when the accelerator is depressed, truck runs at full speed only.	*a.* Improperly adjusted or defective speed potentiometer, foot switches or linkage.	*a.* Adjust speed potentiometer (para 4-21).
	b. Faulty power switch.	*b.* Perform power switch assembly resistance tests. Repair or replace as necessary (para 4-18).
	c. Faulty control board assembly.	*c.* Perform voltage tests. Repair or replace as necessary (para 4-21).
3. Contactors pull in when accelerator is depressed, truck does not move.	*a.* Faulty cabling or wiring.	*a.* Inspect all power cabling and wiring and replace as necessary.
	b. Improperly adjusted or defective speed potentiometer, foot switches or linkage.	*b.* Perform speed potentiometer adjustment (para 4-21).

Table 2-1. Troubleshooting—Continued

Malfunction	Probable Cause	Corrective Action
3. Contactors pull in when accelerator is depressed, truck does not move—Cont'd.	*c.* Faulty control board assembly.	*c.* Perform voltage tests (para 4-21
	d. Faulty power switch assembly.	*d.* Perform power switch assemb resistance test. Replace faul switch (para 4-18).
4. Uneven acceleration or poor inching characteristics.	*a.* Improperly adjusted or defective speed potentiometer, foot switches or linkage.	*a.* Perform speed potentiome adjustment (para 4-21).
	b. Inching potentiometer out of adjustment.	*b.* Perform inching control adjus ment (para 4-21).
5. Inadequate power for climbing grades or pushing loads.	*a.* Low battery (shorted cells).	*a.* Check specific gravity.
	b. Loose power cabling.	*b.* Inspect all connections. Tighten a required.
	c. Faulty battery connector.	*c.* Inspect connector for burned corroded contacts. Repair replace.
	d. Improperly adjusted or defective speed potentiometer, foot switches or linkage.	*d.* Perform speed potentiomete adjustment (para 4-21).
	e. Improper current limit adjustment.	*e.* Perform undervoltage and curre limit test (para 4-21).
	f. Improper undervoltage adjustment.	*f.* Perform undervoltage and curre limit test (para 4-21).
6. Inoperative at high speed.	*a.* Low battery (shorted cells).	*a.* Check specific gravity (TM 1 3930-628-12).
	b. Faulty shunt contactor.	*b.* Check contactor for obviou damage. Repair or replace (pa 4-24).
	c. Faulty cabling or wiring.	*c.* Inspect all cabling and wirin Replace as required.
	d. Faulty electronic power shift shunt control.	*d.* Perform mechanical and dynami switching tests (para 4-21).
7. Excessive contactor arcing.	*a.* Improperly adjusted or defective speed potentiometer, foot switches or linkage.	*a.* Perform speed potentiomete adjustment (para 4-21). Replac defective parts.
	b. Improperly adjusted inching control.	*b.* Adjusting inching control (para 21).
8. Truck moves when directional contactor closes (accelerator control otherwise normal).	*a.* Improperly adjusted or defective speed potentiometer, foot switches or linkage.	*a.* Perform speed potentiomete adjustment. Replace defecti parts.
9. Failure to move.	*a.* Broken axle pinion shaft.	*a.* Replace (para 5-4).
	b. Teeth broken on axle pinion shaft or bull gear.	*b.* Replace (para 5-4).
	c. Broken teeth on differential ring gear, pinion, or internal gears.	*c.* Replace both ring gear an pinion; they are a matched s (para 5-4).
10. Axle noise on drive or coast.	*a.* Excessive wear on ring gear or pinion.	*a.* Adjust if possible, or replace (par 5-4).
	b. Worn pinion gears or side gears in differential case.	*b.* Replace worn gears (para 5-4).
11. Continuous axle noise.	*a.* Excessive wear in gear train.	*a.* Replace worn parts (para 5-4).
12. Excessive backlash in drive unit.	*a.* Worn splines on axle pinion shaft.	*a.* Replace axle pinion shaft (para 4).
	b. Worn pinion, ring gear or differential case pinion.	*b.* Replace (para 5-4).
13. Brake pedal goes to toe board.	External leak in system or leak past master cylinder piston cup.	Check system and master cylinder f leak, and repair (para 6-5).
14. Both brakes drag.	*a.* Foreign material in brake system and/or gumming of cylinder and components.	*a.* Clean out system, replace cups i cylinders (para 6-4) and refi with approved brake fluid (L 10-3930-628-12).
	b. Breather port in master cylinder clogged.	*b.* Clean out breather port (para 5).
15. One wheel drags.	*a.* Obstructed brake line.	*a.* Remove obstruction or repair line
	b. Swollen wheel cylinder piston cups, or piston binding.	*b.* Replace defective or damage parts (para 6-4).

Table 2-1. Troubleshooting—Continued

Malfunction	Probable Cause	Corrective Action
16. Truck pulls to one side.	*a.* Lining charred or drum scored.	*a.* Replace lining. Repair or replace drum (TM 10-3930-628-12).
17. Loose steering.	*a.* Bent or loose linkage and knuckle pins.	*a.* Repair, replace or adjust (TM 10-3930-628-12).
	b. Steering gear bending or out of adjustment.	*b.* Adjust, repair or replace (para 6-24).
	c. Loose steering arm.	*c.* Tighten (para 6-24).
18. Low hydraulic oil pressure.	*a.* Worn pump.	*a.* Inspect and replace (para 3-40).
	b. External leakage.	*b.* Tighten or replace fittings, hoses or seals (TM 10-3930-628-12).
	c. Control valve not properly adjusted or defective.	*c.* Adjust or replace control valve as necessary (para 3-46).
19. Unable to lift or tilt load.	*a.* Load too heavy.	*a.* Check capacity on Serial No. Plate (TM 10-3930-628-12).
	b. Damaged or worn pump.	*b.* Test and repair or replace as required (para 3-40).
	c. Broken lift chain.	*c.* Repair or replace (TM 10-3930-628-12).
	d. Damaged lift cylinders.	*d.* Check for bending or plunger malfunction (para 3-19 & 3-25). Replace defective parts.
	e. Control valve inoperative.	*e.* Test and repair or replace as required (para 3-46).
20. Lift and tilt too slow.	*a.* Internal leakage at pump.	*a.* Disassemble and inspect for leakage or damaged parts. Repair as required (para 3-40).
	b. Excessive leakage at cylinder packing.	*b.* Repair or replace packing (paras 3-6 & 3-19).
	c. Air leaks in system.	*c.* Tighten connections.
	d. Misalignment.	*d.* Check masts, carriage or tilt linkage for binding (para 3-13).
21. Load creeps, tilting or lowering.	*a.* Internal leakage in cylinders.	*a.* Repair or replace packing (para 3-6, 3-19 & 3-25).
	b. Oil leak at packing glands.	*b.* Repair or replace packings (para 3-6, 3-19 & 3-25).
	c. Leak in control valve.	*c.* Check for worn or damaged plungers (para 3-46).
	d. Leaks in oil lines.	*d.* Tighten all connections or replace damaged lines.
22. Noisy pump.	*a.* Pump head loose.	*a.* Tighten.
	b. Worn or broken parts.	*b.* Replace (para 3-40).
23. Oil overheating.	*a.* Internal oil leakage.	*a.* Repair or replace pump (para 3-40).
	b. Pump too tight after overhaul.	*b.* Remove and repair (para 3-38).
	c. Restricted lines.	*c.* Check and repair.

Section III. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS

2-5. Mast Assembly

a. Removal.

(1) Unlock and remove the forks from the carriage, with the mast in its fully retracted position.

(2) Raise the truck and block it 24 inches from the floor to remove the carriage.

(3) Remove screws (11 and 13, fig. 3-8), spacer (9) and lock washers (10) from the carriage supports.

(4) Remove the connector (67, fig. 3-3) and elbow (66) from the flow regulator body (64). Remove regulator body (64) from cylinder.

(5) Attach a hoist to the backrest frame (1, fig. 3-8) and disconnect the chains from the carriage assembly.

(6) Remove the backrest and carriage assembly through the bottom of the inner mast (31, fig. 3-3). Lower truck to floor if desired.

(7) Disconnect the tilt cylinders from the outer mast by removing cotter pins (52), washers (53) and shafts (54).

(8) Using a hoist, raise the mast assemblies enough to remove the weight on the mast pivot pin (56, fig. 3-3). Remove the screws (58), lock washers (59) and pivot pins (56).

(9) Using a hoist, lift the mast assemblies from the truck and place them on suitable supports with the cylinder cluster facing up.

b. Installation.

Note. When using a hoist, always make sure that it has sufficient lifting capacity for the job being performed.

(1) Wrap a chain around the mast and carriage assemblies and with the hoist raised, align the lift cylinder connections with the high pressure hose.

Note. Use a drift pin to align the pivot pin holes on the mast and the truck.

(2) Install the mast pivot pins with the capscrews and lock washers. Connect all lines and hoses that were disconnected during removal.

(3) Install the tilt cylinder pins and lock in place with cotter pins.

(4) Adjust the tilt angle of the mast as outlined in TM 10-3930-628-12.

(5) Install and adjust the lift chains as directed in TM 10-3930-628-12.

(6) Remove the hoisting chain from around the mast. Check all hydraulic connections for leaks.

2-6. Drive Motor

***Warning:* Before any service is performed on the vehicle, make certain that the battery connector has been disconnected.**

a. Removal. To remove the drive motor without removing the drive axle, proceed as follows:

(1) Remove the floor and toe plates, and drip pan.

(2) Disconnect the brake line at the interconnecting tee and remove the line from the master cylinder. Remove the brake line bracket attached to the drive motor flange.

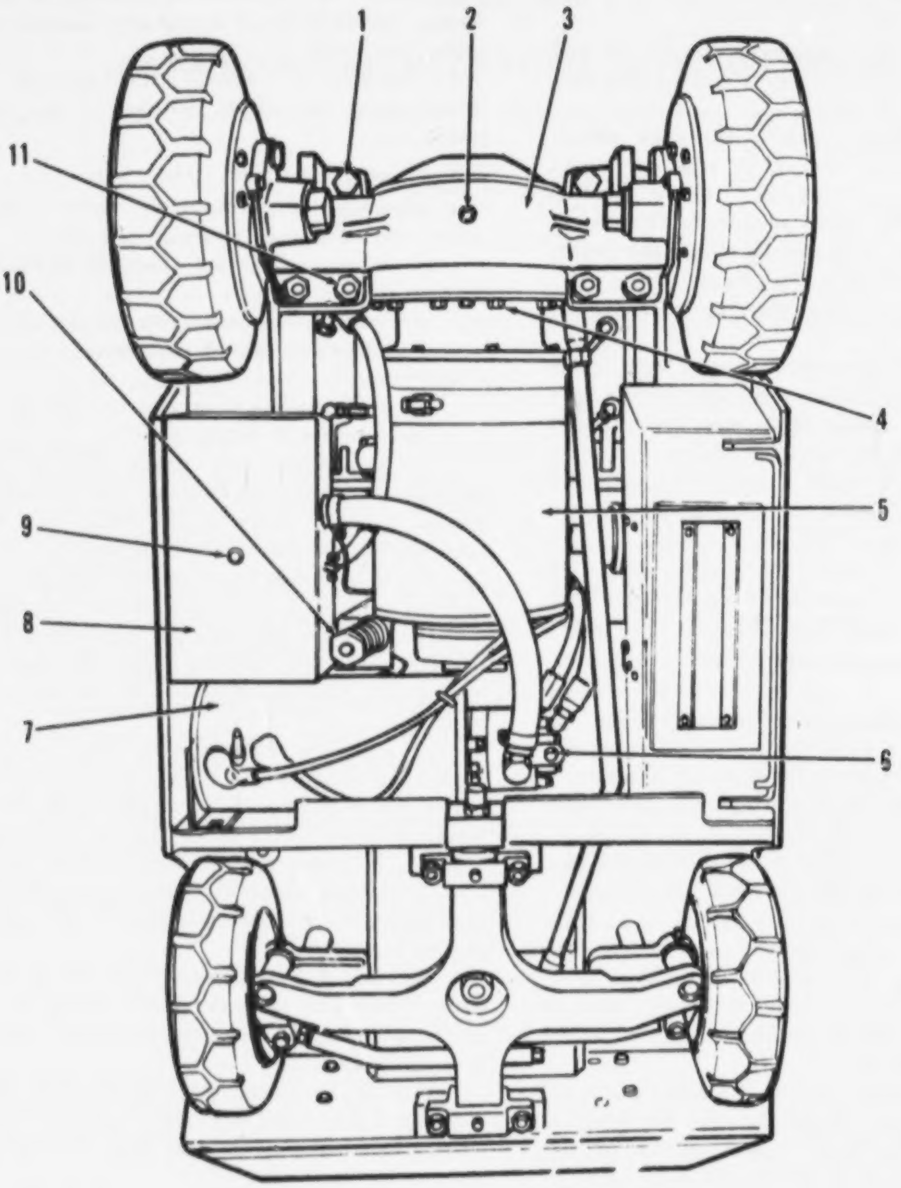
(3) Disconnect drive motor cables and tag cable ends to assure proper installation. Remove thermal relay from motor.

(4) Remove the yoke pin from the parking brake actuating lever and remove the screws securing the seat bracket assembly to the drive motor housing. Remove brake linkage and lower spring (10, fig. 2-1) from motor bracket.

(5) Place a transmission jack or other suitable lifting device under the drive motor. Raise the jack enough to support the drive motor.

(6) Remove the differential housing drain plug (2, fig. 2-1) and drain the differential housing oil.

(7) Remove the wheels and axle shafts.



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1. Screw
2. Drain plug
3. Differential carrier
4. Nut
5. Drive motor
6. Hydraulic pump
7. Hydraulic pump motor
8. Hydraulic reservoir
9. Drain plug
10. Lower spring
11. Nut

Figure 2-1. Underside of truck.

(8) Remove the nuts (4) securing the drive motor (5) to the axle.

(9) Check all lines, hoses, cables, wires and linkages to make certain that none will be damaged during removal.

Caution: **Make certain that the shims between the motor and the axle are not damaged when removing the drive motor. When installing the drive motor to the axles, the shims must be replaced in the same order and position as when the motor is removed.**

(10) Carefully separate the carrier from the axle.

(11) Attach a hoist securely to the front of the truck frame. Raise the truck carefully making sure that all hoses, lines and cables stay clear of the motor. Raise the truck enough to allow the drive motor, carrier, and parking brake to be removed from under the truck. Remove gasket between carrier and axle.

b. Installation. Install the drive motor by reversing the removal procedure. Be sure that the gasket between the carrier and the axle is replaced.

2-7. Hydraulic Pump Motor

a. Removal.

Warning: **Before any service is to be performed on the vehicle, make certain the battery connector has been disconnected.**

(1) Remove the floor and toe plates.

(2) Remove the drip pan.

Note. If the hydraulic oil is to be reused, make certain it is stored in a clean container.

(3) Remove the drain plug (9, fig. 2-1) from the hydraulic oil reservoir (8) and drain the hydraulic oil into a container of suitable size.

(4) Tag and disconnect all hydraulic lines to the pump (6). Tag and disconnect all cables to the hydraulic pump motor.

(5) Attach a chain hoist to the mast assembly and raise the vehicle sufficiently until the truck is high enough to facilitate the removal of the hydraulic pump motor. Block the truck in position.

(6) Place a transmission jack or other suitable lifting device under the pump motor. Remove the screws securing the mounting brackets to the truck frame; carefully lower motor and remove it from under the truck.

b. Installation. Install the hydraulic pump motor using the direct reversal of the removal procedure.

2-8. Drive Motor and Drive Axle

a. Removal. To remove the drive motor and drive axle as a unit, proceed as follows:

(1) Remove the mast assembly as outlined in paragraph 2-5.

Caution: **Before proceeding with drive motor and axle removal, disconnect the battery connector.**

(2) Remove the floor and toe plates.

(3) Remove the drip pan.

(4) Disconnect the brake line at the interconnecting tee and remove the line from the master cylinder. Remove the brake line bracket attached to the drive motor flange.

(5) Disconnect the drive motor electric cables and tag cable ends to assure proper reinstallation.

(6) Remove the yoke pin from the seat brake actuating lever and remove the screws securing the seat brake bracket assembly to the drive motor housing.

(7) Place a transmission jack, or suitable lifting device, under the drive motor and drive unit. Raise the jack enough to support the assembly. Remove the retaining screws (1, fig. 2-1) and nuts (11, fig. 2-1) securing the drive unit to the frame.

(8) Check all brake lines, hoses, cables, wires and linkage to make certain none will be damaged during removal.

(9) Attach a hoist securely to the front of the truck frame and raise the truck carefully making certain all lines and hoses remain clear of the motor and drive unit.

(10) Raise the truck enough to allow the drive motor and drive unit to be removed from under the truck. Carefully pull the assembly out from under the truck.

b. Installation. Install the motor and drive unit by reversing the removal procedure.

CHAPTER 3

REPAIR OF THE HYDRAULIC LIFT COMPONENTS

Section I. GENERAL

3-1. Description

The hydraulic system is comprised of a hydraulic reservoir, a hydraulic pump, control valve, three section mast assembly, tilt cylinders, and associated hydraulic hoses and hose connections. Refer to figure 3-1.

3-2. Operation

a. Pump Action. The hydraulic pump draws oil from the hydraulic reservoir and supplies oil under pressure to the control valve.

b. Lift Control.

(1) When the lift control handle is pulled back, hydraulic oil is delivered through the control valve to the two outer cylinders on the cylinder cluster (42, fig. 3-3). Oil pressure forces the two outer cylinder rams upward, raising the chains and lifting the carriage up the mast. Continued raising actuates the center cylinder of the cluster and the single lift cylinder.

(2) When the lift control handle is released to neutral, hydraulic oil pressure will hold the carriage stationary.

(3) When the lift control handle is pushed forward, hydraulic oil pressure is released and the carriage and masts are lowered by their own weight.

c. Tilt Control.

(1) When the tilt control handle is pushed forward, hydraulic oil pressure is applied through the control valve to the rear of the tilt cylinders. The cylinder plunger rods move forward and tilt the masts forward. At the same time, hydraulic oil in the front of the tilt cylinders is recirculated through the control valve.

(2) When the tilt control handle is centered, hydraulic oil pressure is equalized in both sides of the tilt cylinders and the masts remain in the desired tilt.

(3) When the tilt control handle is pulled back, hydraulic oil pressure is applied through the control valve to the front of the tilt cylinders. The cylinder plunger rods move backward, resulting in a backward tilt of the masts. At the same time, hydraulic oil in the rear of the tilt cylinders is recirculated through the control valve.

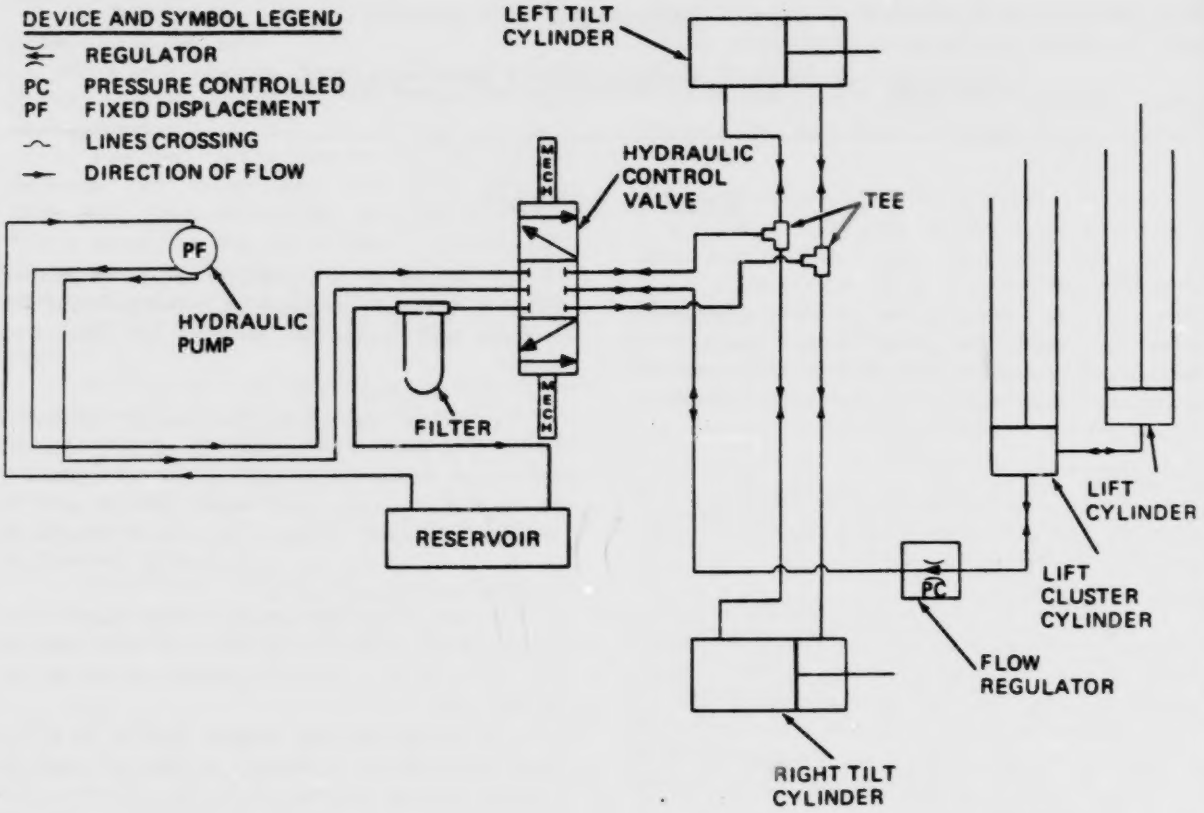
DEVICE AND SYMBOL LEGEND
REGULATOR
PC PRESSURE CONTROLLED
PF FIXED DISPLACEMENT
LINES CROSSING
DIRECTION OF FLOW
LEFT TILT CYLINDER
HYDRAULIC CONTROL VALVE
TEE
PF
HYDRAULIC PUMP
MECH
FILTER
MECH
RESERVOIR
LIFT CYLINDER
LIFT CLUSTER CYLINDER
PC
FLOW REGULATOR
RIGHT TILT CYLINDER

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Figure 3-1. Hydraulic lift system, schematic.

Section II. TILT CYLINDER

3-3. Description

The two double acting cylinders serve to tilt the mast assembly. They are located under the toe plate and pivot at the frame and mast brackets. Action of the tilt cylinder is a straight line motion. Any misalignment of the tube assembly (24, fig. 3-2) and the quad ring (13) will cause rapid wear of the internal parts and may break the tube assembly weld.

3-4. Removal

Remove cotter pins (52, fig. 3-3), washers (53) to disconnect cylinder from mast. Disconnect hydraulic lines from cylinder, remove nut (2, fig. 3-2) and shoulder bolt (1) at rear of cylinder and remove cylinder from truck.

3-5. Disassembly

a. Refer to figure 3-2 and disassemble as follows:

b. Secure the tilt cylinder in a bench vise. Be careful not to deform the cylinder tube.

c. Remove the screw (3), lock washers (5), nut (6) and yoke (4). The yoke is threaded onto the tilt cylinder plunger (18).

d. Remove the gland nut (22) and preformed packing (21).

e. Remove the wiper ring (23), quad ring (19) and the back-up ring (20) from inside the gland nut (22).

f. Withdraw the plunger rod (18) from the cylinder tube assembly.

g. Remove the cotter pin (16), the castellated nut (17) and piston assembly from the plunger rod (18).

h. Remove the piston packing (11) from the base of the piston (15).

i. Remove the quad ring (13) and the two back-up rings (12 and 14) from the groove around the outside diameter of the piston (15).

j. Remove the two spacers (9 and 10).

3-6. Cleaning, Inspection and Replacement

a. Clean all metal parts with cleaning solvent (Fed. Spec. P-D-680). Dry parts thoroughly with compressed air.

b. Check the tube bore for scores or nicks.

c. Check the sliding surfaces on piston (15) for scores, nicks or irregularities.

d. Check all back-up rings for cracks, bends, deformation, stripped threads and other damage.

e. Replace all packing, wiper rings and other damaged or worn parts as authorized.

3-7. Assembly

a. Refer to figure 3-2 and assemble as follows:

b. Dip all preformed packings, quad rings, and wiper rings in hydraulic oil before assembly.

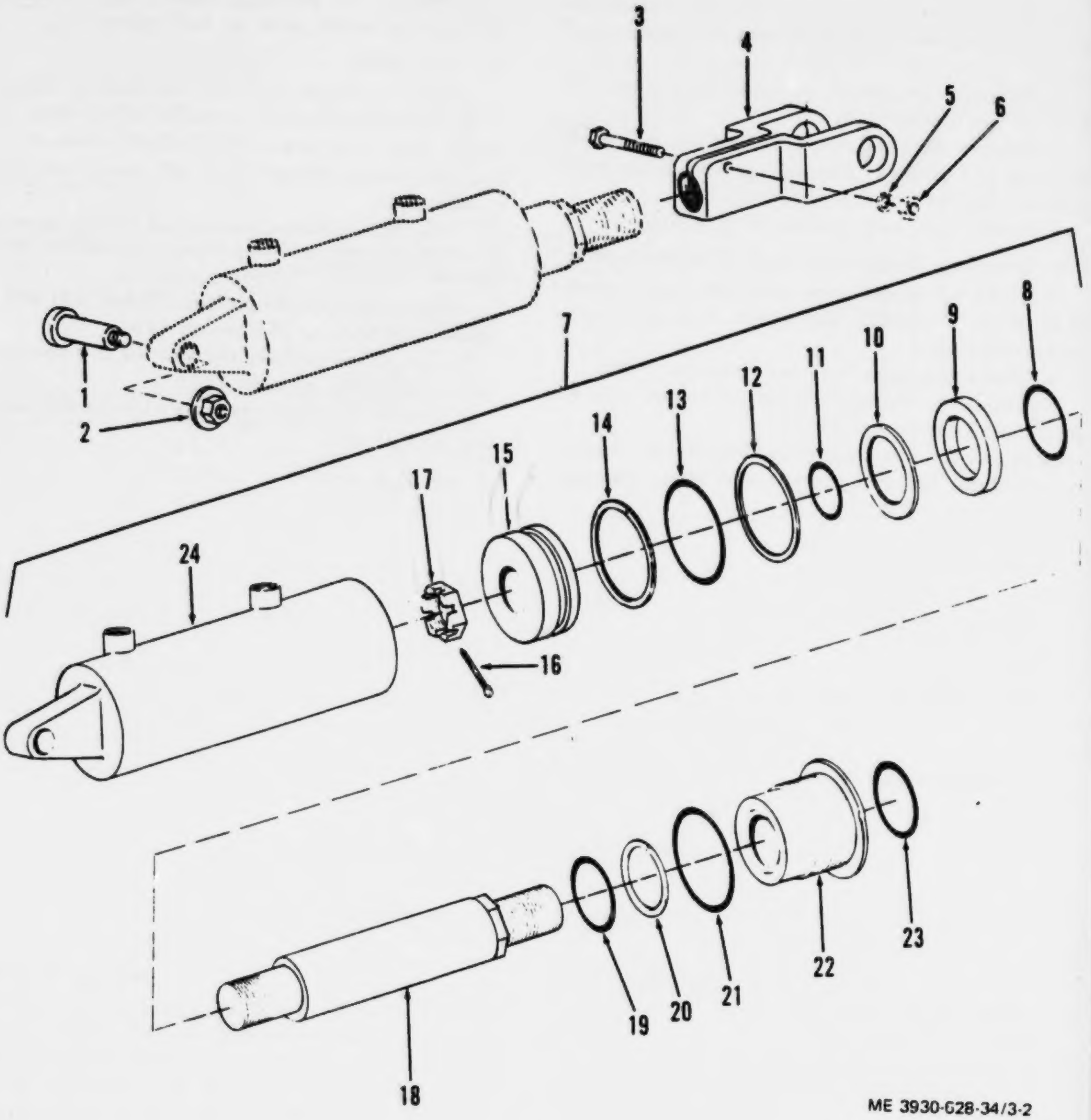
c. Oil piston, plunger rod and gland nut before installation.

Note. When installing packing and back-up rings onto the piston, do not stretch the packing or expand the back-up rings any more than necessary.

d. Install the back-up rings (12 and 14) and the quad ring (13) on the piston (15).

e. Install the packing (8) and the two spacers (9 and 10) on the plunger (18).

f. Install the piston packing (11) in the bore of the piston (15).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1. Bolt, shoulder
2. Nut, flanged
3. Screw
4. Yoke
5. Lock washer
6. Nut
7. Cylinder assembly
8. Preformed packing
9. Spacer
10. Spacer
11. Preformed packing
12. Back-up ring
13. Quad ring
14. Back-up ring
15. Piston
16. Cotter pin
17. Nut
18. Plunger rod
19. Quad ring
20. Back-up ring
21. Preformed packing
22. Gland nut
23. Wiper ring
24. Tube assembly

Figure 3-2. Tilt cylinder and associated parts.

g. Install the piston assembly onto the plunger (18) and secure with the nut (17). Tighten the nut to a torque of 125 foot-pounds and secure in place with cotter pin (16).

h. Install the two rings (19 and 23) and the back-up ring (20) into the bore of the gland nut (22).

i. Place the packing (21) on the outside of the gland nut (22).

j. Install the plunger rod with its assembled parts in the tube assembly (24) and secure in place with the gland nut. Tighten the gland nut securely, then back off approximately ⅛ turn.

k. Screw on yoke (4) and secure in place with the screw (3), lock washer (5), and nut (6).

3-8. Installation and Adjustment

a. Install cylinder on truck and attach rear of cylinder to frame with shoulder bolt (1, fig. 3-2) and nut (2).

b. Attach front end of cylinder to mast with shaft (54, fig. 3-3), washers (53) and cotter pins (52).

c. Refer to TM 10-3930-628-12 to adjust mast tilt angle.

Section III. MAST ASSEMBLY

3-9. Description

a. The mast assembly is a three section mast assembly designed to provide lifts up to 144 inches. Three masts, nested together, comprise the assembly; an outer mast, intermediate mast and an inner mast. Each mast consists of a structural steel frame, with mounting brackets and blocks welded to it to support the cylinders, chains and bearings.

b. The intermediate and inner masts ride on roller bearings, allowing them to telescope up and down. Alignment of the mast channels is accomplished by adjusting the roller bearings.

c. A carriage, designed to mount the lifting forks, is supported by chains leading from the outer cylinders of the cylinder cluster. Action of the chains, cylinders, and mast raise and lower the carriage.

d. Power to raise and lower the masts and carriage is provided by hydraulic oil pressure to a cylinder assembly and cylinder cluster. The cylinder assembly is a single cylinder attached to the inner portion of the intermediate mast with the cylinder ram extending through an opening in the intermediate mast and anchored at the lower part of the outer mast.

e. The cylinder cluster, consisting of three cylinders, is mounted forward of the cylinder assembly in the intermediate mast. The rams of the two outer cylinders mount the two crosshead and chain bearing assemblies, with the chains attached to adjusting anchors in mounting brackets on the cylinders. The chains extend over the bearings and attach at the other end to anchors on the carriage. Chain guards, mounted on the crossheads and cylinders, keep the chains from striking the cylinder plungers and packing. Rams from the outer cylinders lift and lower the carriage along the length of the inner mast by means of the chains. The center cylinder of the cluster has the ram anchored at the bottom of the intermediate mast and the top of the cylinder attached to the inner mast.

f. The bottom of the outer mast has pivot blocks, with bearings, for mounting to the truck. Pivot blocks are also provided on the outer mast to connect the tilt cylinders to the mast.

g. An interlock assembly, spring actuated, is mounted on the right beam of the inner mast. The interlock assembly locks all three mast sections in the lowered position until full free lift is accomplished. When full free lift is reached, the carriage stop screw strikes the interlock assembly to release it, allowing all mast sections to function completely.

3-10. Operation

a. When the lift handle on the control valve is pulled to the rear, hydraulic oil pressure is delivered to the two outer cylinders of the cylinder cluster. Pressure forces the cylinder rams to extend upward, raising the chains and lifting the carriage up the mast. Speed of lift is controlled by motor speed and by valve opening.

b. As the carriage reaches the top of the inner mast the two outer cylinder rams will be extended to their farthest point of travel. With the handle pulled to the rear, the hydraulic oil pressure will then force the center cylinder ram of the cylinder cluster from the cylinder, raising the inner mast and carriage.

c. As the center cylinder ram reaches its farthest extent of travel the inner mast will be fully extended above the other two masts with the carriage at the top. Continued operation will cause the ram of the single cylinder to force downward against the outer mast, raising the intermediate mast. Full extension of the ram will raise the carriage to the highest level.

d. When the lift handle on the control valve is released to neutral, hydraulic oil pressure will hold the carriage at the required height. To lower the carriage, push the handle forward. The hydraulic oil pressure will be released allowing the carriage and masts to lower to the desired height. A flow regulator holds lowering speed to a maximum of 70-80 fpm. The regulator is installed in the single lift cylinder hose connection at the bottom o outer mast.

3-11. Removal

Refer to paragraph 2-5 and remove the carr and mast assembly.

KEY to fig. 3-3:

1. Screw
2. Outer mast
3. Stud
4. Spacer
5. Spacer
6. Bearing
7. Nut
8. Bearing
9. Spacer
10. Spacer
11. Bracket
12. Screw
13. Washer
14. Screw
15. Single lift cylinder
16. Nut
17. Screw
18. Washer
19. Guard
20. Screw
21. Shaft
22. Anchor
23. Chain
24. Spacer
25. Roller bearing
26. Spacer
27. Crosshead
28. Ring
29. Screw
30. Washer
31. Inner mast
32. Pin
33. Interlock
34. Screw
35. Spacer
36. Screw
37. Spring
38. Screw
39. Bearing
40. Spacer
41. Spacer
42. Cylinder cluster
43. Elbow
44. Tube
45. Connector
46. Screw
47. Washer
48. Guard
49. Intermediate mast
50. Washer
51. Nut
52. Cotter pin
53. Washer
54. Shaft
55. Bushing
56. Pivot pin
57. Washer
58. Screw
59. Fitting
60. Fitting
61. Washer
62. Nut
63. Preformed packing
64. Regulator body
65. Flow regulator
66. Elbow

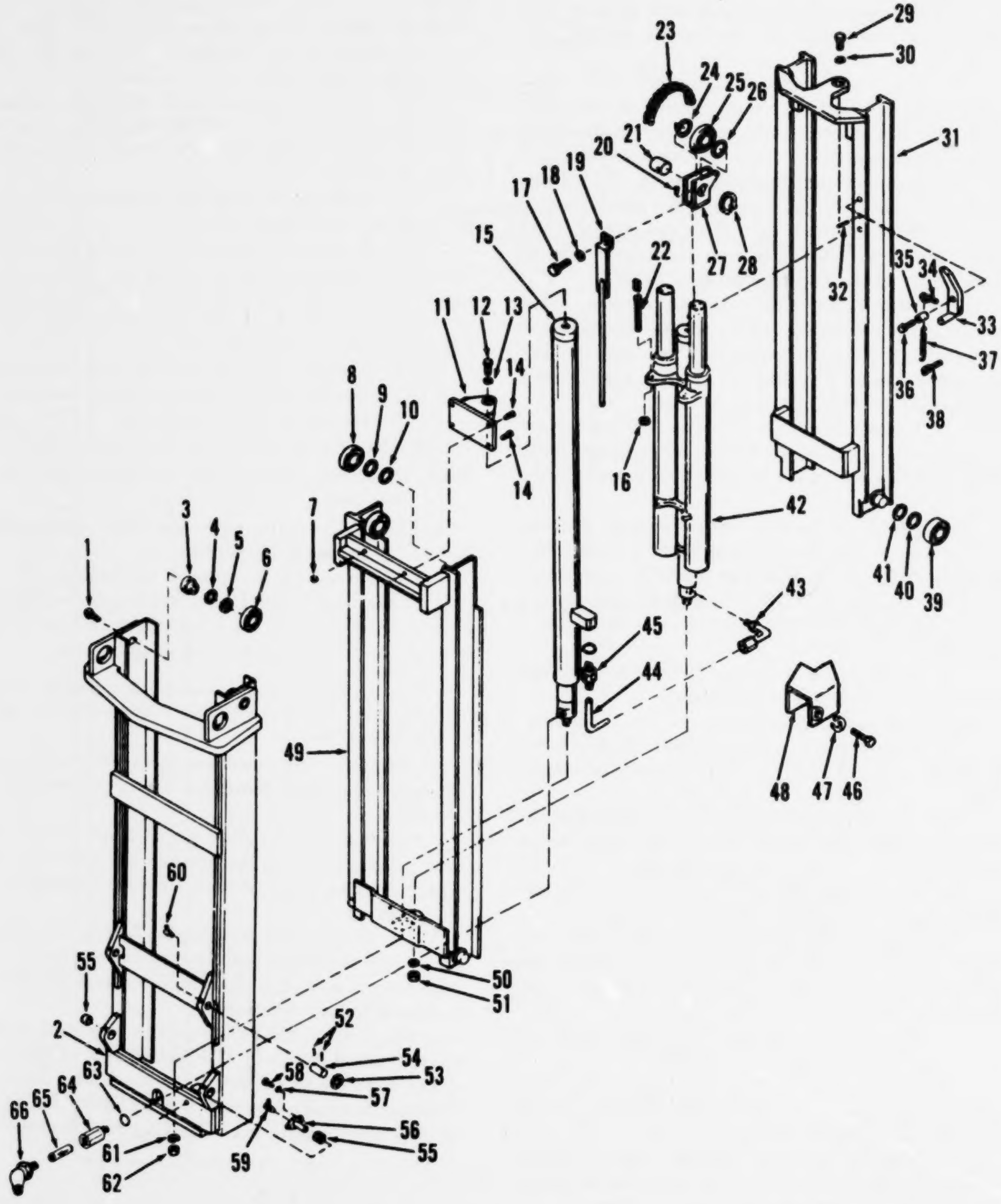
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Figure 3-3. Mast assembly.

3-12. Disassembly

a. Refer to figure 3-3 and disassemble as follows:

b. Remove inner mast (31) as follows:

(1) Remove screw (29) and lock washer (30) connecting inner mast to the center cylinder of cylinder cluster (42).

(2) Remove bottom adjustment nuts (16) from chain anchors (22) and remove chains (23) from cylinder cluster (42) and inner mast (31). Match-mark location of nuts (16) on anchors (22).

(3) Remove the interlock spring (37) from screws (34 and 38) and remove the screws.

(4) Remove the screw (36) and spacer (35) from the interlock (33); remove the interlock from inner mast (31). Tap out the pin (32).

Caution: **Do not raise the inner mast beyond the clearance point or the inner mast bearing (39) will contact the upper intermediate mast bearing (8), which may result in damage to the bearings.**

(5) Using a hoist, slowly raise the inner mast (31) until the notch at the bottom of the inner mast channel clears the upper intermediate mast bearing (8).

(6) Check to see that the inner mast bearing (39) will clear the notch in the upper intermediate mast channel. If both bearings (8 and 39) are clear, remove the inner mast (31) from the intermediate mast (49) by carefully moving the hoist in a horizontal direction.

(7) Remove the bearings (39) and the spacers (41 and 40) if they are to be replaced.

c. Remove the intermediate mast (49) as follows:

(1) Remove the capscrew (46), lock washer (47) and guard (48) from the intermediate mast (49).

(2) Disconnect the elbow (43), connector (45) and tube (44) from the cylinder cluster and single lift cylinder.

(3) Remove screw (17), lock washer (18), and chain guard (19) from crosshead (27).

(4) Remove the retaining rings (28) from the shaft (21). Tap out the shaft and remove the bearing (25) and spacers (24 and 26) from the crosshead (27).

(5) Remove the screws (20) and crosshead (27) from the cylinder cluster (42).

(6) Remove the nut (51) and lock washer (50) securing the center cylinder of the cylinder cluster (42) to the intermediate mast (49).

Caution: **Always handle the cylinder cluster in the fully collapsed position to avoid scratching or nicking the ram surface.**

(7) Using a hoist, remove the cylinder cluster (42) from the intermediate mast (49).

(8) Remove screw (12) and lock washer (13) attaching upper part of single lift cylinder (15) to bracket (11), and screws (14) and nuts (7) attaching bracket to the intermediate mast (49).

(9) Remove the bracket (11) from the intermediate mast (49).

(10) Remove the nut (62) and lock washer (61) securing the bottom of the single lift cylinder (15) through the intermediate mast (49) to the outer mast (2).

(11) Remove the single lift cylinder (15) from the intermediate mast (49).

(12) Remove the screws (1), studs (3), shims (4 and 5), and bearings (6) at the top of the outer mast (2). Note the size and quantity of shims used.

(13) Using a hoist, slide the intermediate mast (49) from the outer mast (2).

(14) Remove the bearing (8) and shims (9 and 10), from the intermediate mast, if necessary.

(15) Remove the bearings (55) and lubrication fittings (60) from the outer mast (2).

3-13. Cleaning, Inspection, Replacement and Repair

a. Clean all parts with cleaning compound, solvent (Fed. Spec. P-D-680).

b. Inspect all parts for wear or damage.

c. If the inner race of the bearing is fractured, examine the bearing stud for nicks. Replace the bearing and stud if damaged as follows:

Note. All bearing studs are welded into position except the outer mast bearing stud, which is attached to the outer mast with a screw.

(1) Press the bearings from the studs and remove the shims. Note the size and quantity of shims used.

(2) Remove the filler metal from around the stud using a small, round grinder. Do not make any passes into the mast channel. Remove the stud from the channel.

(3) Prepare the welding surface by removing all foreign material such as rust, scale, grease, etc. Any part that may be damaged by heat should be removed before welding.

(4) Locate, tilt and align the new stud on the mast channel (fig. 3-4). Use section B-B of figure 3-4 for dimensions of the inner mast bearing stud location. Sections A-A and B-B of figure 3-4 apply to the intermediate mast bearing stud locations.

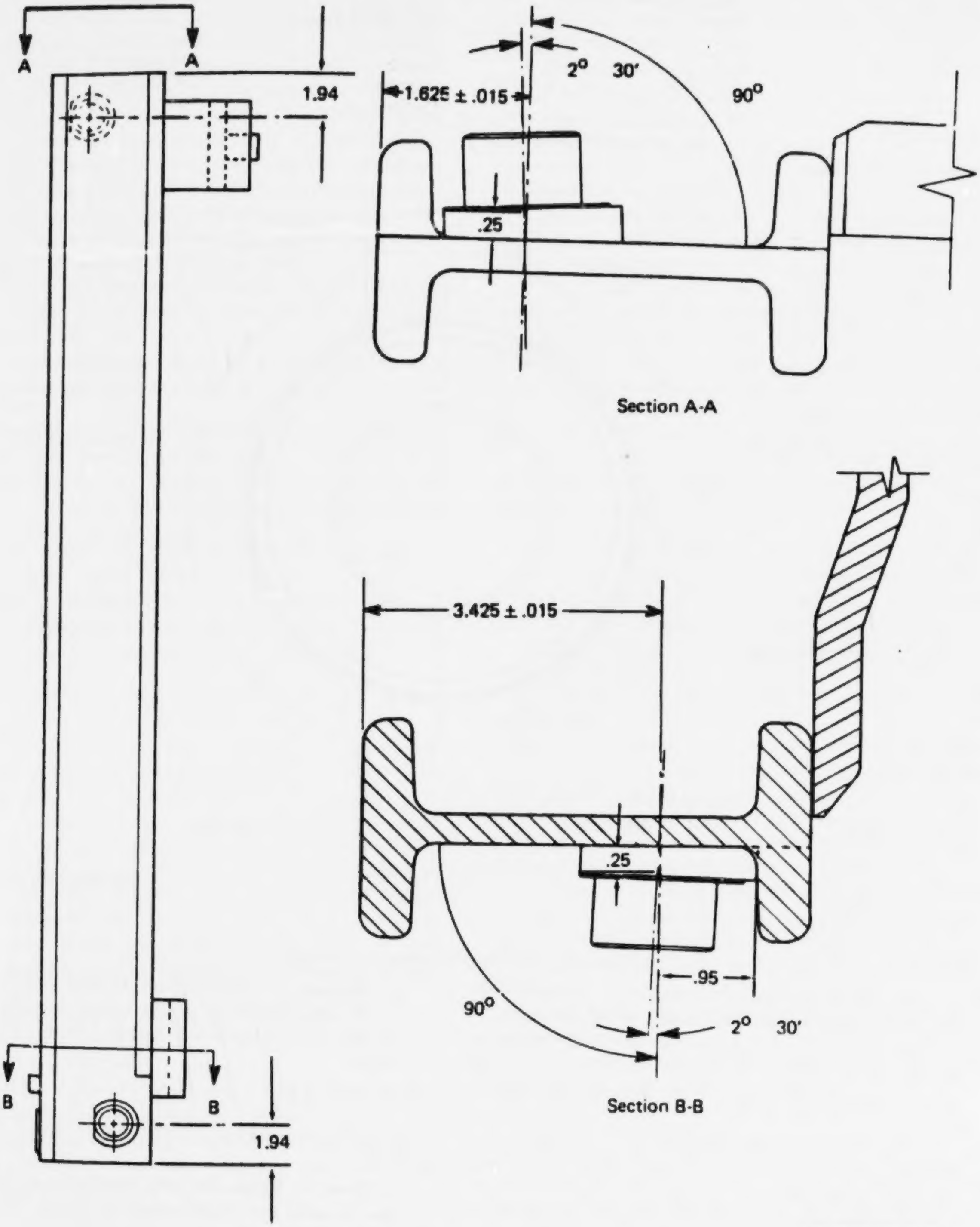
A
A
1.94
1.625 ± .015
2° 30′
90°
.25
Section A-A
3.425 ± .015
.25
.95
90°
2° 30′
Section B-B
B
B
1.94

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Figure 3-4. Mast bearing stud locations.

(5) Comply with the following welding specifications using bearing stud welding procedure (fig. 3-5):

Process	Shielded Metal Arc
Equipment	Manual
Settings:	
Current	A. C.
Amps	275 / 325
Volts	31 / 33
Base Metals	(1) AC 1035-D
	(2) AC 41L40-HT (roller stud)
Plate Thickness Range	⅜" - 1"

Electrode:	
Type	Stick
Class	E 7018 (hydrogen free)
Size	⅛"
Flux	Electrode Covering
Weld Type and Size	¼" Fillet
Number of Passes	1
Position	Horizontal
Preheat	400 degrees F
Interpass	250 degrees F
Postheat	None

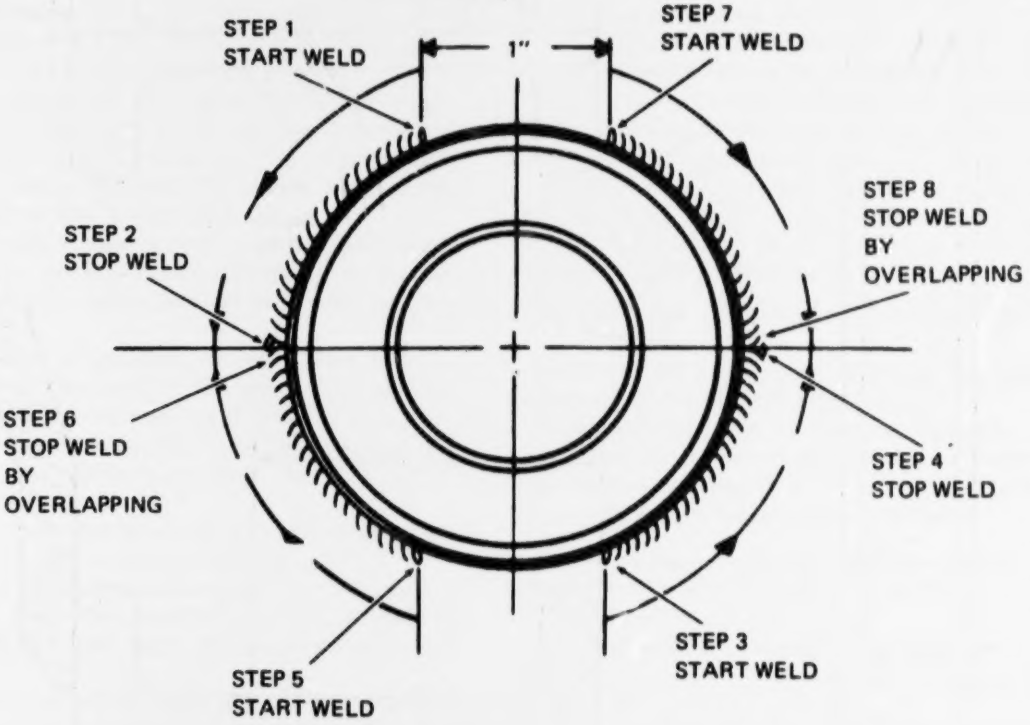

STEP 1
START WELD
1"
STEP 7
START WELD
STEP 8
STOP WELD
BY
OVERLAPPING
STEP 2
STOP WELD
STEP 6
STOP WELD
BY
OVERLAPPING
STEP 4
STOP WELD
STEP 3
START WELD
STEP 5
START WELD
ME 3930-628-34/3-5

Figure 3-5. Bearing stud welding procedure.

(6) When welding is completed, remove all slag, weld spatter, and excessive weld material.

(7) Remove the defective material with a small, round grinder in 0.010—0.020 of an inch passes and visually inspect for defects after each pass.

d. Inspect the mast channels for misalignment, broken welds, excessive wear, and worn or damaged wear strips.

e. Inspect the pivot and tilt cylinder brackets on the outer mast for wear or damage. Check the pivot bearing.

f. Repair by welding is practical, provided heat distortion is avoided.

g. Replace defective parts as authorized.

h. If the studs or outer mast bearings ar replaced, the attaching screws must also b replaced.

3-14. Assembly

Note. Prior to assembly, lubricate all parts per LO 10-393 628-12.

a. Refer to figure 3-3 and assemble as follows:

b. Install the lubrication fittings (60) and bearings (55) in the outer mast (2).

c. Assemble the intermediate mast (49) a follows:

(1) Install the bearings (8) and the same size and quantity of shims (9 and 10) on the welded intermediate mast studs, if the bearings and shims were removed during disassembly.

(2) Using a hoist, slide the intermediate mast (49) into the outer mast (2).

(3) Using the same size and quantity of shims used when removed, install the studs (3), shims (4 and 5), and bearings (6) at the top of the outer mast. Secure the studs to the mast with screws (1).

(4) Check the clearance between the outer mast bearings (6) and mating intermediate mast channels and intermediate mast lower bearings and mating outer mast channels. The clearance should be no more than 0.015 of an inch.

(5) If the clearance is more than 0.015 of an inch, remove the bearing and install additional shims (4 and 5).

Note. Divide the shims as equally as possible between the bearings. Shims are available in 0.015 and 0.040 inch thicknesses.

(6) When proper shimming is completed, install bearings (6) on the outer mast (2) and tighten screws (1) to a torque of 245 foot-pounds.

(7) Secure bracket (11) to the intermediate mast (49) with screws (14) and nuts (7).

(8) Install the single lift cylinder (15) on the intermediate mast (49) and secure to the top bracket with lockwasher (13) and screw (12).

(9) Install new packing (63), flow regulator body (64), flow regulator (65), elbow (66) and connector (67).

(10) Using a hoist, install the cylinder cluster (42) on the intermediate mast (49).

(11) Secure the center cylinder of the cylinder cluster to the bottom of the intermediate mast with lockwasher (50) and nut (51).

(12) Attach the crossheads (27) to the outer cylinders of the cylinder cluster with screws (20).

(13) Install the bearings (25), spacers (24 and 26), and shafts (21) in the crossheads and secure with retainers (28).

(14) Install the chain guards (19) on the crossheads (27) with lockwashers (18) and screws (17).

(15) Connect the elbow (43), tube (44) and connector (45) from the cylinder cluster to the single lift cylinder.

d. Assemble the inner mast (31) as follows:

(1) Install the bearings (39) and the same size and quantity of shims (40 and 41) on the inner mast welded bearing stud, if the bearings and shims were removed during disassembly.

(2) Using a hoist, install the inner mast (31) on the intermediate mast (49) being careful that the bearings (39) clear the notches.

(3) Lower the inner mast (31) slightly into the intermediate mast (49). Check the clearance between the intermediate mast upper bearings and inner mast channel and inner mast bearings and intermediate mast channel. Clearance should not be more than 0.015 of an inch.

(4) If clearance is more than 0.015 of an inch, install additional shims (40 or 41). See operation *c* (4) note.

(5) When proper shimming is completed, install bearings (39) and slide the inner mast completed into the intermediate mast.

(6) Install the pin (32) into the middle hole on the inner mast and secure the interlock (33) in the upper hole with spacer (35) and screw (36).

(7) Install both screws (34 and 38) and connect the interlock spring to them.

(8) Attach the chains (23) to the cylinder cluster (42) with adjustment nuts (16) and anchors (22), noting match-mark nut locations on screws. Final adjustment of the chains will be made after the carriage is installed.

(9) Secure the cylinder cluster (42) to the top of the inner mast with lock washer (30) and screw (29).

3-15. Installation

a. Using a hoist, install mast assembly on the truck and insert the pivot pins (56, fig. 3-3). Secure with the lock washers (57) and screws (58).

b. Connect the hydraulic line to the flow regulator body.

c. Connect the tilt cylinders to the outer mast (para 3-8).

d. Using a hoist, slide the backrest and carriage assembly up the inner mast and secure to chains with chain anchors. Before releasing the hoist, check to ensure that the chains are secure at the cylinder cluster and running evenly, with no twists, through the crosshead bearings.

e. Remove the hoist from the carriage and install screws (11 and 13, fig. 3-8), spacer (9) and lock washers (10) in carriage roller supports.

f. Remove the blocks and lower the truck to the floor.

g. Install the carriage forks making sure the fork is locked in position.

h. Check for complete lubrication of mast assembly (LO 10-3930-628-12).

i. Check lift for proper operation as follows:

(1) Lower carriage to the lowest point of travel. The bottom of the lower carriage bar should be adjusted from 2¾ to 3¼ inches from the floor. Refer to TM 10-3930-628-12 for adjustment of chains.

(2) Using extreme care, very slowly extend the

mast to full lift checking all moving parts for binding, interference, or excessive looseness or play.

(3) Check the operation of the interlock assembly. The interlock must contact the stop screw on the carriage roller support and disengage smoothly when lifting the carriage.

Section IV. CYLINDER CLUSTER

3-16. Description

The cylinder cluster consists of three cylinder assemblies and is mounted forward of the single cylinder assembly in the intermediate mast. The rams of the two outer cylinder mount the two crosshead and chain bearing assemblies, with the chains attached to the chain anchors in mounting brackets on the cylinders. The outer rams lift and lower the carriage along the length of the inner mast by means of chains. The center cylinder has its ram anchored at the bottom of the intermediate mast and its cylinder attached to the inner mast. Forcing downward, the center ram raises the carriage and inner mast to their fullest extent.

3-17. Removal

To remove the cylinder cluster without removing the inner mast, refer to figure 3-3 and proceed as follows:

Caution: **When disassembling or reassembling the cylinders, use extreme care to avoid damaging the finish of ram surfaces.**

a. Raise the inner mast (31) approximately 24 inches from floor and block in this position.

b. Remove the carriage as follows:

(1) Remove the screws and spacer from the carriage roller supports.

(2) Remove the carriage forks.

(3) Attach a hoist to the carriage, remove the chain anchor pins, and disconnect the chains (23) from carriage.

(4) Lower the carriage out of the bottom of the inner mast.

c. Disconnect the lift chains (23) from the chain anchors (22) on the top of the cylinder cluster and then remove chains through the bottom of the mast. Match-mark the nut positions on anchors.

d. With the cylinders completely collapsed, disconnect the center cylinder of the cluster at the elbow (43).

e. Remove the nut (51) and lock washer (50) securing the cluster center cylinder to the intermediate mast (49).

f. Using a hoist carefully lift the cylinder cluster (42) from the intermediate mast (49).

g. Remove the chain anchors (22) and nuts (16) from the cluster.

h. Remove the screws (17), lock washers (18), and chain guards (19) from the crossheads (27).

i. Remove the bearing shaft retainer (28) and tap out the bearing shaft (21), and remove washers (24 and 26) and bearings (25) from the crossheads.

j. Remove the screws (20) and crossheads (27) from the top of the cylinder cluster (42).

3-18. Disassembly

a. Refer to figure 3-6 and disassemble as follows:

Note. Disassembly applies to both outer and center cylinder assemblies, unless otherwise specified.

b. Remove the gland nut (6) from the tube (12) with a spanner wrench and discard the locking pellets (5).

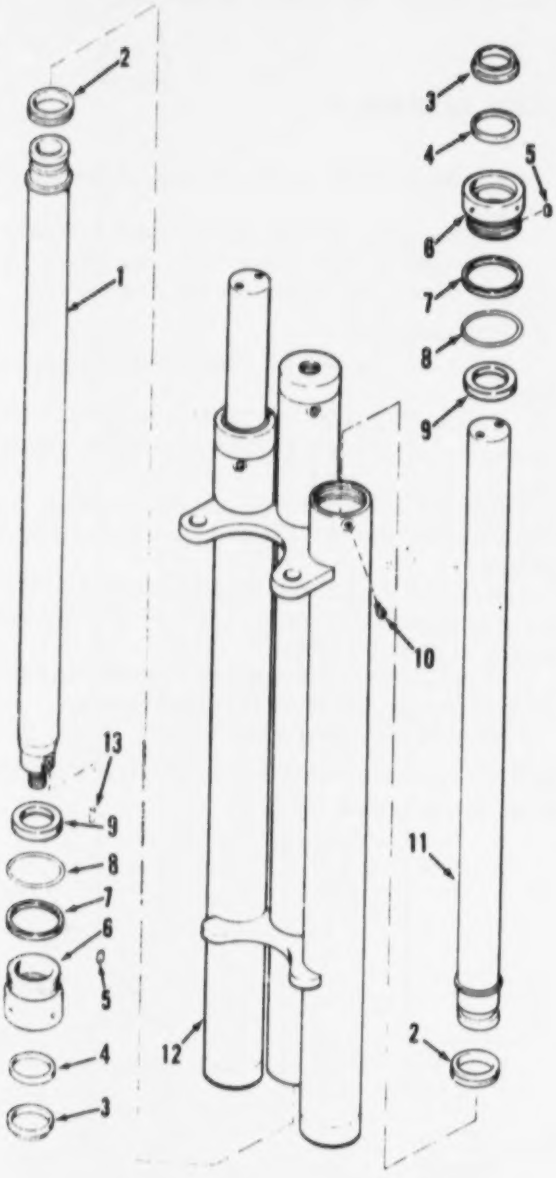
c. Remove the wiper ring (3) and packing (4) from the gland nut (6). Discard the wiper ring and packing.

d. Remove the backup ring (7), packing (8), and stop ring (9) from the ram (1 and 11). Discard the backup ring and packing.

e. Remove the spring pin (13) from the center ram (1).

f. Carefully slide the rams (1 and 11) from the tube (12) and remove the wear block (2) from the ram.

g. Remove the bleed screws (10).



1. Center ram
2. Wear block
3. Wiper ring
4. Packing
5. Locking pellet
6. Gland nut
7. Backup ring
8. Packing
9. Stop ring
10. Bleed screws
11. Outer ram
12. Tube assembly
13. Pin

Figure 3-6. Cylinder cluster, exploded view.

3-19. Cleaning, Inspection, and Replacement

a. Clean all metal parts with cleaning compound, solvent (Fed. Spec. P-D-680). Dry thoroughly with dry, compressed air.

b. Inspect the parts for wear or damage. Remove nicks and scratches with fine emery paper.

c. Replace all the packing, wiper rings, and backup rings regardless of condition. Replace all other unserviceable parts as authorized.

3-20. Assembly

a. Refer to figure 3-6 and assemble as follows:

Note. Assembly applies to both outer and center cylinder assemblies unless otherwise specified.

b. Loosely install the bleeder screws (10) in the tubes (12).

c. Install the wear blocks (2) on the rams (1 and 11) and carefully slide the rams into the tubes (12).

d. Insert the spring pin (13) in the center ram (1).

e. Install the stop ring (9), new packing (8), and backup ring (7) on the ram (1 and 11).

f. Install a new wiper ring (3) and packing (4) in the gland nut (6).

g. Using new locking pellets (5), secure the gland nut (6) to the tube (12) with a spanner wrench.

3-21. Installation

To install the cylinder cluster without installing the inner mast, refer to figure 3-3 and proceed as follows:

a. Install the crossheads (27) on top of cylinder cluster and secure with screws (20).

b. Install bearings (25), washers (24 and 26), the bearing shafts (21) in the crossheads (27) and secure the assemblies to crossheads with the bearing shaft retainer (28).

c. Install the chain guards (19) on crossheads, with the rods through the holes in the cylinder brackets. Secure the guards to the crossheads with screws (17) and lock washers (18).

d. Using a hoist, carefully install the cylinder cluster (42) on the intermediate mast and secure at the bottom with the nut (51) and lock washer (50).

e. Attach the chains (23) to the chain anchors (22) and install the anchors and nuts (16), noting match-mark of previous adjustment.

f. Run the chains evenly around the bearings (25), allowing them to hang free.

g. Connect the tube assembly (44) to the center cylinder at the elbow (43).

h. Using hoist, raise carriage into inner mast (31) and attach the chains to the chain anchors.

i. Lower the inner mast and install the screws and spacer on carriage roller supports and carriage forks. Install and lock forks in position.

j. Using the chain anchors (22) and nuts (16), adjust the carriage to 2¾ to 3¼ inches from floor. Adjust both anchors to equal the chain tension.

k. Check to see that the bleeder screws are loose. Operate the control valve to actuate the cylinders and slowly raise and lower mast. When a clear, bubble free oil flow from bleeder screw hol obtained, tighten the bleeder screws.

Section V. SINGLE CYLINDER ASSEMBLY

3-22. Description

The single cylinder assembly is installed on the inner portion of the intermediate mast, with the cylinder ram extending through an opening in the intermediate mast and anchoring at the lower part of the outer mast. The upper portion of the cylinder is secured in a bracket. Forcing the single cylinder ram downward against the outer mast will raise the intermediate mast. Full extension of the ram will raise the carriage to its highest level.

3-23. Removal

To remove the single cylinder assembly without removing the inner mast, proceed as follows:

Caution: **When disassembling or reassembling cylinders, use extreme care to avoid damaging the ram surface finish.**

a. Remove cylinder cluster (para 3-17).

b. Refer to figure 3-3 and continue removal as follows:

c. Remove the screw (12) and lock washer (13) attaching the cylinder to the bracket (11) at the top of the intermediate mast.

d. Remove the nut (62) and lock washer (61) securing the cylinder to the bottom of the o mast (2).

e. Using a hoist, remove the cylinder assem from the intermediate mast (49) and place supports to prevent rolling during disassembl

3-24. Disassembly

a. Refer to figure 3-7 and disassemble follows:

b. Remove the gland nut (8) from tube (3) w a spanner wrench and discard the locking pell (5).

c. Remove the wiper ring (6) and packing (from the gland nut (8). Discard the wiper ring a packing.

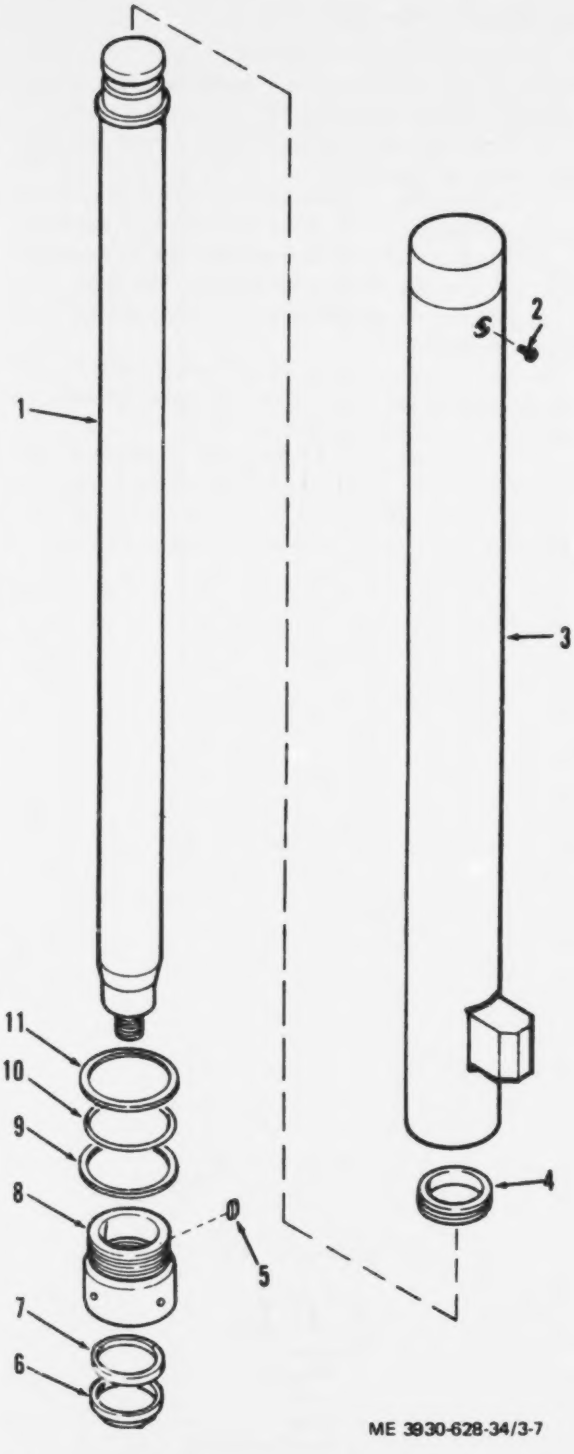
d. Remove the backup ring (9), packing (1 and stop ring (11) from the ram (1). Discard t backup ring and packing.

e. Carefully slide the ram (1) from the tube (and remove the wear block (4) from the ram.

f. Remove the bleed screw (2).

3-25. Cleaning, Inspection, and Replaceme

Refer to paragraph 3-19.



1. Ram
2. Bleed screw
3. Tube assembly
4. Wear block
5. Pellet
6. Wiper ring
7. Packing
8. Gland nut
9. Backup ring
10. Packing
11. Stop ring

Figure 3-7. Single cylinder assembly, exploded view.

3-26. Assembly

a. Refer to figure 3-7 and assemble as follows:

b. Loosely install the bleeder screw (2) in the tube (3).

c. Install the wear block (4) on the ram (1) and carefully slide the ram into tube (3).

d. Install the stop ring (11) and new packing (10) and backup ring (9) on the ram.

e. Install the new packing (7) and wiper ring (6) in the gland nut (8).

f. Using new locking pellets (5), secure the gland nut (8) to the tube (3) with a spanner wrench.

3-27. Installation

To install the single cylinder assembly without removing the mast, refer to figure 3-3 and proceed as follows:

a. Using a hoist, remove the single cylinder assembly from the supports and install the cylinder through the intermediate mast (49) and secure to the outer mast (2) with the lock washer (61) and nut (62).

b. Secure the cylinder assembly to the bracket at top of intermediate mast (49) with the lock washer (13) and screw (12).

c. Install cylinder cluster as described in paragraph 3-21, being sure to tighten the bleeder screw (2, fig. 3-7) when a clear, bubble free oil flow is obtained.

Section VI. CARRIAGE AND BACKREST ASSEMBLIES

3-28. Description

The fork lift carriage frame assembly is a welded assembly having two horizontal fork supports and two vertical carriage supports. The carriage supports each carry two welded stud bearing assemblies, which ride in the inner mast channels. The backrest assembly is a welded frame attached to the upper fork support. It serves to prevent loads from resting against the mast when the mast is tilted back.

3-29. Removal and Disassembly

a. Fully retract mast assembly and unlock and remove carriage forks.

b. Refer to figure 3-8 and remove and disassemble as follows:

c. Using a hoist, remove the screws (3) and lock washers (2) attaching the backrest (1) to t carriage frame assembly (7). Remove backrest.

d. Raise the inner mast 24 inches from the flo and block in position.

e. Remove the screws (11 and 13), spacer (and lock washers (10) from the carriage suppor

f. Attach a hoist to the carriage frame assemb (7), remove the slack and balance the load.

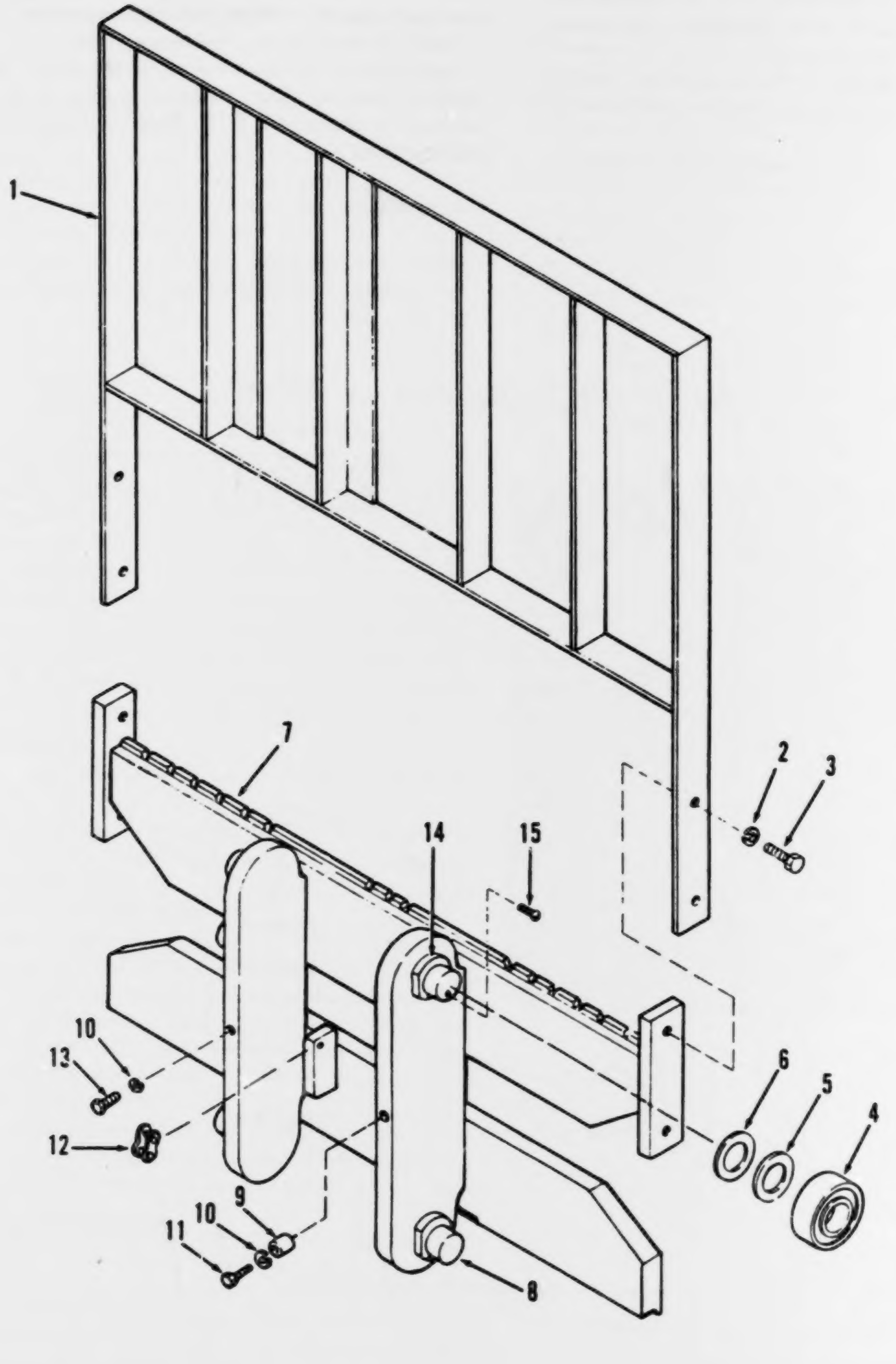
g. Disconnect the chains (12) from the carria frame assembly (7).

h. Slowly lower the carriage frame assembly o the bottom of the inner mast and place on suitab supports, bearing assemblies up.

i. Noting the size and quantity of shims (5 a 6), remove the bearings (4) and shims from t welded studs (8 and 14) on carriage suppor Remove screw (15) to remove upper bearing.

KEY to fig. 3-8:

1. Backrest
2. Lock washer
3. Screw
4. Bearing
5. Shim
6. Shim
7. Frame assembly
8. Stud
9. Spacer
10. Lock washer
11. Screw
12. Chain link
13. Screw
14. Upper stud
15. Screw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ME 3930-628-34/3-8

Figure 3-8. Backrest and carriage assembly, exploded view.

3-30. Cleaning, Inspection and Replacement

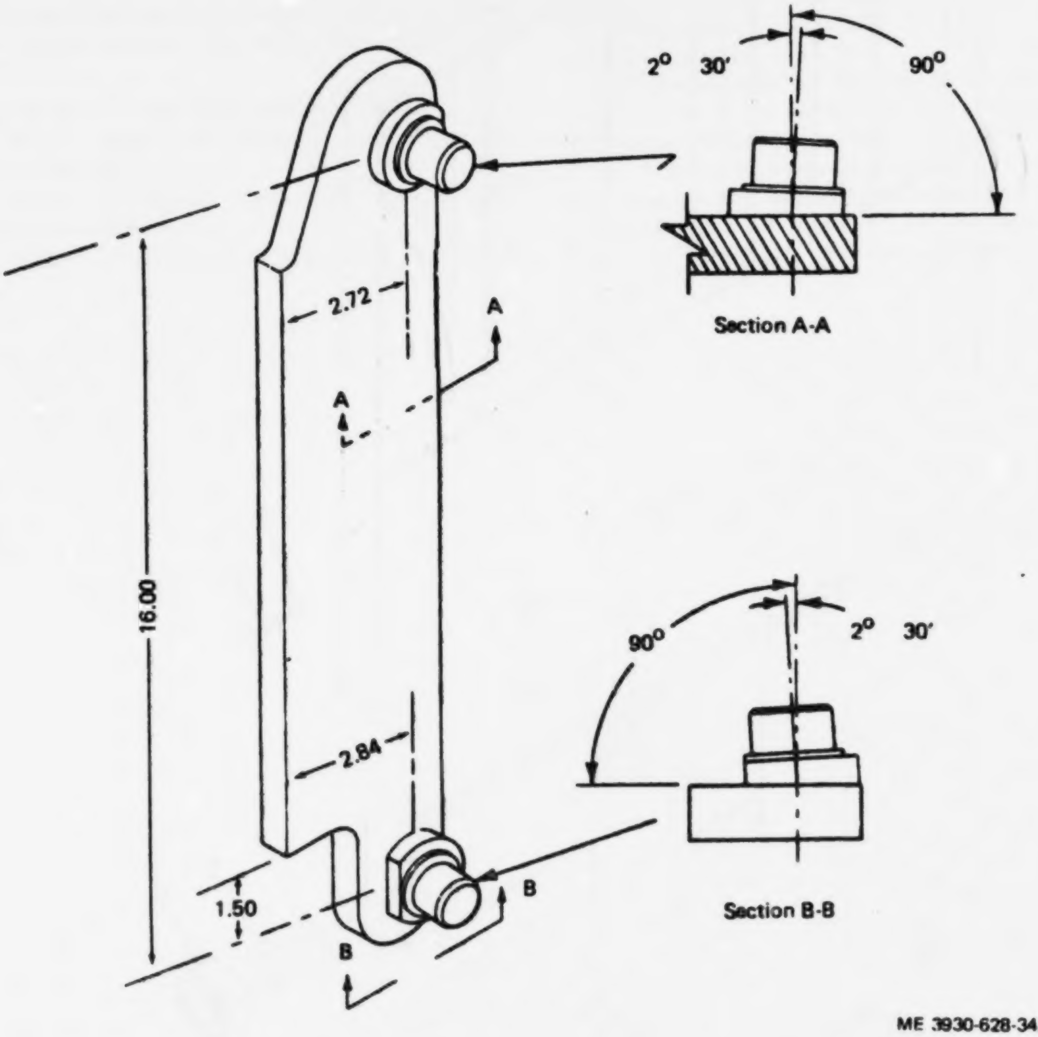
a. Clean the parts with cleaning compound, solvent (Fed. Spec. P-D-680).

b. Inspect the backrest for cracked or broken welds, and any wear or bends which could interfere with heavy use.

c. Inspect the frame assembly for cracked or broken weldments, unusual wear or bends, and misalignment of vertical carriage supports.

Note. Examine the stud weldments closely.

d. Repair parts by welding if practical. When welding the bearing studs use the procedure outlined in paragraph 3-13. Refer to figure 3-9 for stud location.



ME 3930-628-34/3-9

Figure 3-9. Carriage roller stud location.

e. Replace defective parts as authorized.

3-31. Assembly and Installation

a. Refer to figure 3-8 and assemble and install as follows:

b. Install the same size and quantity of shims (5 and 6) as found in disassembly. Install the bearings (4). Secure upper bearing with screw (15). Tighten screw only to snug fit.

c. Using a hoist, raise and lower the carriage frame assembly in the inner mast channels several times to check for free movement throughout the entire range of travel. If the bearings bind, reshim to 0.015 of an inch clearance between the bearings and the mast channel.

Note. Divide the shims as equally as possible between the bearings. Shims are available in 0.015 and 0.040 inch thicknesses.

d. When the carriage frame moves freely within the clearance specified, secure the chains with the anchor pins to the frame. Before releasing the hoist, check to see that chains are secure at the cylinder cluster and running evenly, with no twists, through the crosshead bearings.

e. Install the screws (11 and 13), spacer (9), and lock washers (10) in carriage supports.

f. Remove the blocks and lower the inner mast to the floor using a suitable hoist.

g. Using a hoist, install the backrest (1) on the carriage frame (7) with lock washers (2) and screws (3).

h. Operate the mast assembly and check the carriage movement for side play and binding. If necessary, remove the carriage and backrest assembly again and reshim. Alignment of the inner mast channels and bearings should also be checked, if a second removal is necessary.

i. Lower the carriage to the lowest point of travel, check the distance from the lower horizontal fork support to the floor. The distance should be adjusted within a 2¾ to 3¼ inch range. Refer to TM 10-3930-628-12 for adjustment procedure.

j. Install and lock the carriage forks.

Section VII. HYDRAULIC RESERVOIR

3-32. Description

A hydraulic reservoir, located under the floor plate in the driver's compartment, contains sufficient oil for the entire hydraulic system. The tank is of welded construction. Oil is added through a gage opening and measured on a screened gage installed in the tube. The reservoir is drained through a pipe plug installed in the bottom of the tank. Oil is withdrawn by the pump and returned from the control valve via a hydraulic oil filter through tubing.

3-33. Removal

a. Refer to figures 3-10 and 3-11 and remove as follows:

b. Remove the floor plates. Drain the reservoir by removing the drain plug located at the bottom of the hydraulic reservoir. Disconnect hoses from reservoir. Plug ends of hoses.

c. Remove the breather (1, fig. 3-11), gage (2), and screen (3) from the top of the reservoir (8).

d. Tag and disconnect the electrical leads at the thermal relays (refer to figure 3-10) mounted on the hydraulic reservoir. Remove the nuts and lock washers securing the thermal relays to the reservoir: remove the relays.

e. Lift the front end of the truck and block in position to permit removal of the reservoir.

f. Block the reservoir to support it during removal.

g. Remove the screws (8 and 10, fig. 3-11), washers (6), lock washers (5) and nuts (4).

h. Slowly lower and remove the reservoir (7).

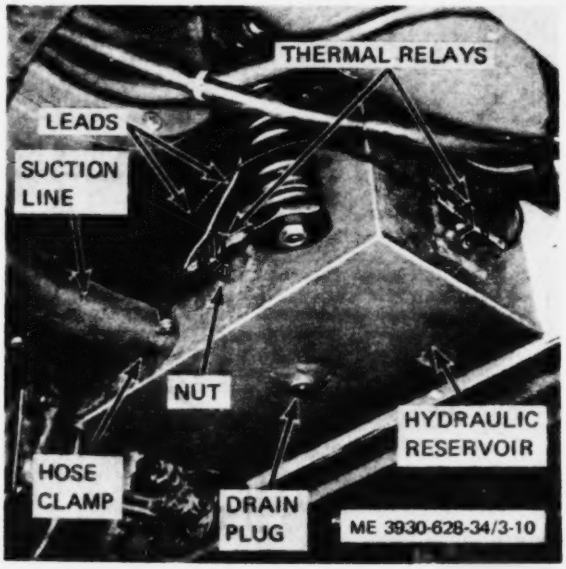
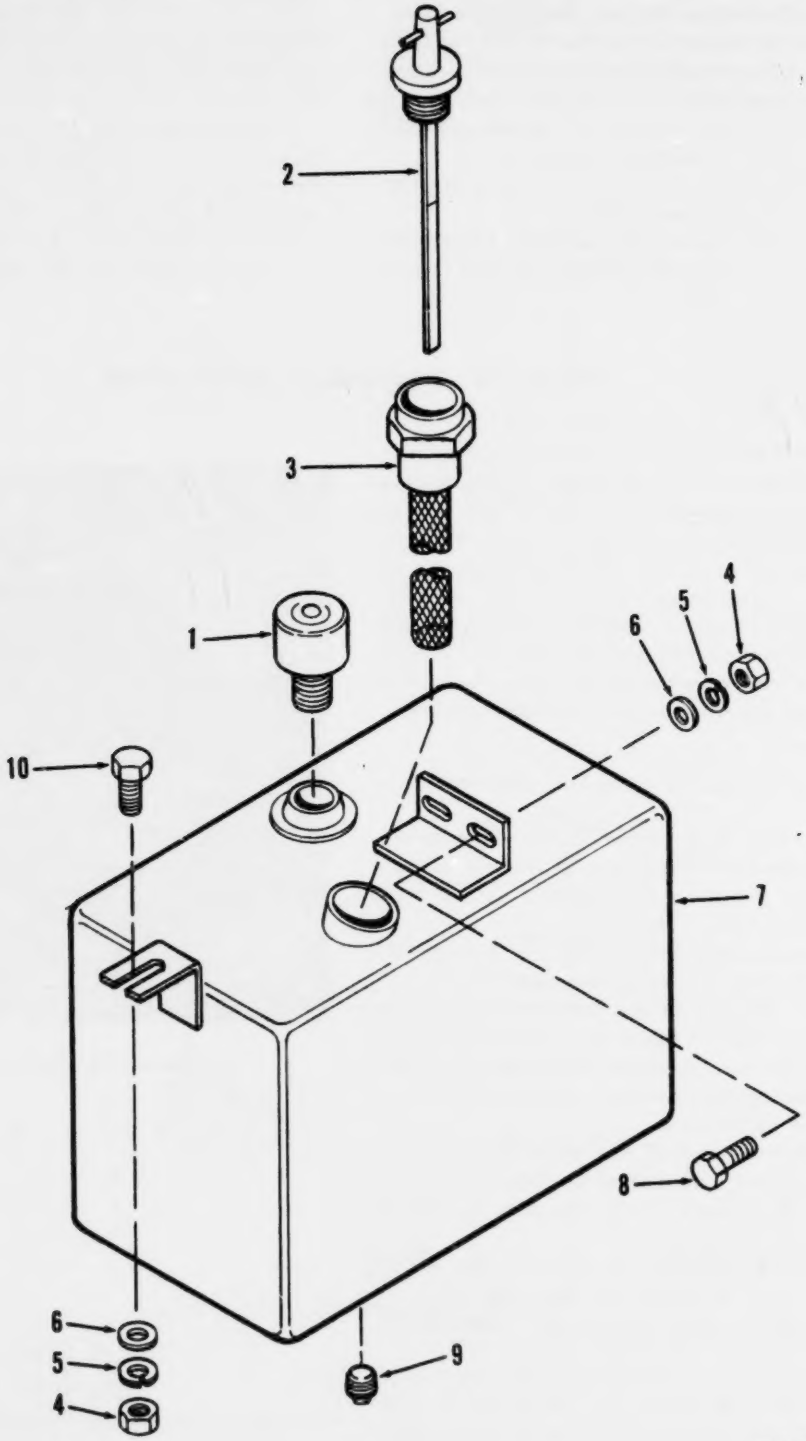


Figure 3-10. Hydraulic oil reservoir.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ME 3930-628-34/3-1

Figure 3-11. Hydraulic oil reservoir, exploded view.

KEY to fig. 3-11:

1. Breather
2. Gage
3. Screen
4. Nut
5. Lock washer
6. Washer
7. Reservoir
8. Screw
9. Drain plug
10. Screw

3-34. Cleaning and Inspection

a. Flush the reservoir (7, fig. 3-11) with cleaning compound, solvent (Fed. Spec. P-D-680). Dry thoroughly with compressed air.

b. Inspect the tank for rust, cracked seams or damaged threads.

c. Clean the breather and gage screen with a reverse flow of hydraulic fluid or compressed air.

d. Inspect all parts for damage and replace as authorized.

3-35. Repair

a. If damage is such that repair by welding is possible, flush the tank thoroughly to remove all traces of explosive solvents, both liquid and vapor.

Note. The reservoir must be thoroughly cleaned and flushed after repair.

b. If the tank is beyond reasonable welding repair, replace as authorized.

3-36. Installation

a. Refer to figures 3-10 and 3-11 and install as follows:

b. Using care not to damage tubing, lift the reservoir (7, fig. 3-11) into position at the bottom of the truck and secure it with screws (8 and 10), washers (6), lock washers (5), and nuts (4).

c. Install the drain plug in the bottom of the tank.

d. Connect the suction line to the tank.

e. Secure the thermal relays in place with nuts and washers. Remove the tags and connect the electrical leads to the relays.

f. Check that the reservoir is securely mounted and then lower the truck.

g. Connect the return line to the top of the reservoir.

h. Install the breather (1) and screen (3) in the reservoir (7).

Caution: NEVER USE BRAKE FLUID. When filling the tank, make sure that the containers and the surrounding parts are clean, to prevent oil contamination. Any hydraulic oil that is used must contain a rust preventative and an oxidation inhibitor. The oil should not foam.

i. Refer to LO 10-3930-628-12 and fill the reservoir with the specified hydraulic oil.

j. Install the gage (2) in the tank.

k. Install the floor plates.

Section VIII. HYDRAULIC PUMP

3-37. Description

The hydraulic pump is a tandem type dual gear unit driven directly by the series wound hydraulic pump motor. The pump has a common suction port and two discharge ports (primary and secondary). The primary discharge port supplies hydraulic oil to the control valve for the tilt cylinders, whereas the secondary discharge port supplies hydraulic oil to the lift cylinder. The internal parts of the pump are machined to a high degree of accuracy and the tolerances are very close.

3-38. Removal

a. Refer to figure 3-12 and remove the hydraulic pump as follows:

b. Raise the rear of the truck to gain access to the hydraulic pump and block the truck in the raised position. Drain the hydraulic system.

Caution: **Make certain that the battery connector is disconnected. Turn the key switch ON and OFF several times to discharge the capacitors, then leave the key in the OFF position.**

c. Tag and disconnect the suction hose and the primary and secondary discharge hoses. The hydraulic hoses should be plugged upon removal to prevent the entry of foreign material into the system and the loss of hydraulic fluid.

d. Remove the screws and lock washers securing the pump to the pump motor. Pull the pump shaft out of the armature shaft.

3-39. Disassembly

a. Refer to figure 3-13 and disassemble the hydraulic pump as follows:

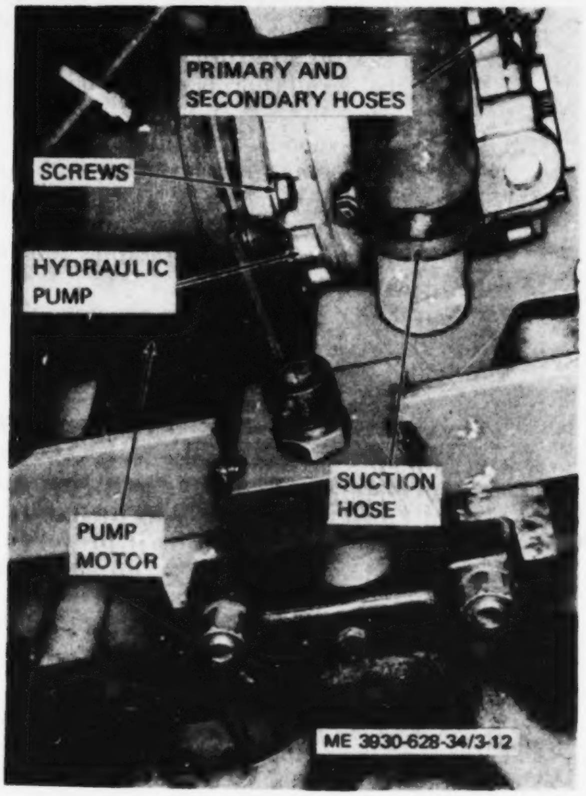

Figure 3-12. Hydraulic pump removal.

KEY to fig. 3-13:

1. Key
2. Idler gear and shaft
3. Drive gear and shaft
4. Diaphragm
5. Back-up gasket
6. Gasket protector
7. Diaphragm seal
8. Spring
9. Ball
10. Front plate
11. Oil seal
12. Dowel pin
13. Body
14. Body adapter
15. Screw
16. Lock washer
17. Port adapter
18. Gasket protector
19. Diaphragm seal
20. Gasket protector
21. Back-up gasket
22. Diaphragm
23. Slip fit gears
24. Gear body
25. Preformed packing
26. Backplate
27. Screw
28. Screw
29. Screw

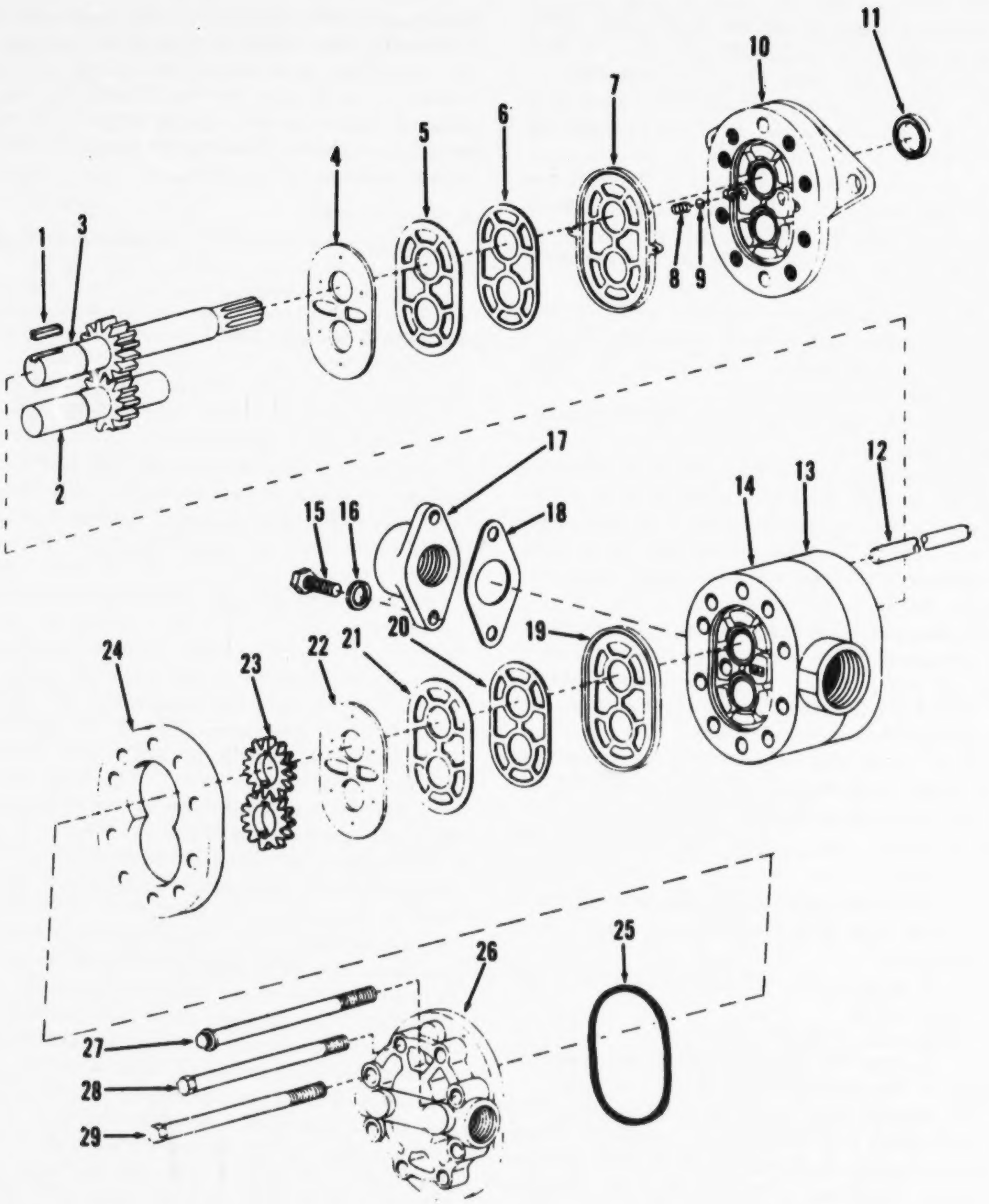
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Figure 3-13. Hydraulic pump, exploded view.

b. Clean the outside of the pump thoroughly with cleaning compound, solvent (Fed. Spec. P-D-680).

c. Scribe a mark across the back plate (26), body (24) and body (13), body adapter (14) and front plate (10) to assure proper reassembly.

d. Cover the drive gear shaft (3) splines with tape to protect the splines and oil seal (11) during disassembly.

e. Remove the screws (27, 28 and 29) from the back plate (26). Separate the back plate (26) from tne slip-fit gear body (24).

f. Remove the packing (25) from the back plate (26).

g. Remove the screws (15) and lock washers (16) from the port adapter (17). Separate the port adapter (17) and gasket (18) from the body adapter (14).

h. Carefully shake the pump to remove the slip-fit gears (23).

i. Remove the key (1) from the gear shaft (3).

j. With a rubber mallet, tap the splined end of the drive shaft (3) to separate the front plate (10) from the body (13). Remove the drive shaft and gear assembly (3) and the idler shaft and gear assembly (2) from the front plate (10).

k. Remove the diaphragm (4 and 22), back-up gasket (5 and 21), gasket protector (6 and 20), and diaphragm seal (7 and 19) from the front plate (10) and body assembly (14). Remove steel balls (9) and springs (8) from front plate (10).

l. With a drift pin, remove the dowel pins (12) securing the body (13) and body adapter (14). Separate the body and adapter.

3-40. Cleaning, Inspection and Replacement

a. *General.*

(1) Clean all parts with cleaning compound, solvent (Fed. Spec. P-D-680). Dry thoroughly with compressed air.

(2) Remove nicks and burrs from all parts with emery cloth.

b. *Drive and Idler Gears.*

(1) Inspect the drive gear shaft for a broken keyway or damaged splines.

(2) Inspect both the drive gear and the idler gear at bearing and seal contact points for rough surfaces or excessive wear. If the shafts measure less than 0.6850 inch in the bearing area, the gear assembly must be replaced.

(3) Inspect the drive, idler and slip-fit gear faces for scoring and excessive wear. If the gear width of the drive gear and idler gear assemblies is less than 0.767 inch, they should be replaced. If the slip-fit gears are less than 0.371 inch in width, they must be replaced.

c. *Bearings.*

Note. The bearings are part of the plate assemblies (10 and 26) and are not available separately.

(1) Inspect all bearing oil grooves for nicks and burrs.

(2) Measure the inside diameter of the bearings. If the inside diameter is greater than 0.691, the plate assemblies must be replaced.

(3) The gear pockets (large internal diameters) in the gear bodies (24 and 13) must be checked for excessive wear and scoring. The bodies should be replaced if the inside diameter of the gear pocket exceeds 1.719 inches.

3-41. Assembly

a. Refer to figure 3-13 and assemble the pump as follows:

Note. All parts must be coated with clean hydraulic oil before assembly. All seals, gaskets and diaphragms should be replaced with new parts. Care must be taken to keep all parts clean during assembly.

b. Tuck the diaphragm seal (7) into the grooves in the front plate assembly (10) with the open part of the "V" section down.

c. Press the gasket protector (6) and back-up gasket (5) into the diaphragm seal (7). Drop the steel balls (9) into the seats in the front plate assembly (10) and position the springs (8) over the balls.

d. Place the diaphragm on the top of the back-up gasket, bronze face up.

e. Repeat steps *b*. *c*. and *d* above for installing the diaphragm seal (19), gasket protector (20), back-up gasket (21) and diaphragm (22) in the body adapter (14). The intake hole in the diaphragm must be aligned over the intake hole in the face of the body adapter.

f. Slide the gear assemblies (2 and 3) through the bearings in front plate (10).

g. Apply a thin coat of heavy grease to both milled faces of the body (13). Position the body over the gears onto the front plate (10). The half moon port cavities in the body must face away from the front plate. The small drilled hole in one of the cavities must be on the pressure side of the pump.

h. Install dowel pins (12) in body adapter (14). Slide the body adapter (14) over the gear shaft and tap into place on body (13) with a rubber mallet. Install the key (1) on the drive shaft (3) and slide the slip-fit gears (23) onto the shafts.

i. Coat both of the milled surfaces of the slip-fit gear body (24) with a thin coat of heavy grease. Slide the body (24) over the gears (23) onto the body adapter (14). The half moon cavities in the body must face away from the body adapter. The small drilled hole in one of the cavities must be on the pressure side of the pump.

j. Position the back plate (26) onto the slip-fit gear body (24). Secure the pump sections together with screws (27, 28 and 29). Tighten the screws to a torque of 25 foot pounds.

k. Position the port gasket (18) and port adapter

(17) on the pump housing (14) and secure in place with screws (15) and lock washers (16). Tighten to a torque of 10-12 foot pounds.

l. Work the shaft seal (11) over the drive shaft (3) into position in the front plate (10). Oil the seal liberally when installing. Take care not to damage the oil seal rubber lip.

m. Rotate the pump shaft by hand and check for excessive binding. The pump will have a small amount of drag, but should turn freely after a short period of use.

3-42. Installation

a. Slide the pump drive gear shaft into the internal splines in the hydraulic pump motor armature shaft. Secure the pump to the pump motor housing with screws and lock washers. Refer to figure 3-12.

b. Unplug the hydraulic hoses and reconnect them to the pump.

c. Raise the truck, remove the blocks and lower the truck to the floor. Operate the control valve for several minutes and check the operation of the pump.

d. Check and replenish the hydraulic oil supply as directed in LO 10-3930-628-12.

Section IX. HYDRAULIC CONTROL VALVE

3-43. Description

The hydraulic control valve serves to direct pressurized hydraulic oil from the hydraulic pump to the tilt or lift cylinders. It contains two operating plungers, two check valves, and an adjustable relief valve. The single acting plunger operates the lift cylinders and the double acting plunger operates the tilt cylinders. When over 1200 psi oil pressure is applied, the check valve allows oil flow to either the lift or tilt cylinders when the levers are activated. The adjustable relief valve is a protective device that prevents damage to the hydraulic system due to pressures over 2000 psi. Such pressures are normally caused when the lift or tilt cylinders reach full stroke and continued pump operation builds up pressure. If the pressure rises above the relief valve pressure adjustment (1850 to 1950 psi), then the valve unseats and allows oil to by-pass the plungers and return, through a filter, to the reservoir.

3-44. Removal

a. Make sure that the lift cylinders are collapsed and the mast is tilted all the way forward.

b. Remove the center cover panel in the operator's compartment to expose the control valve and connections.

c. Tag, disconnect and plug all the hydraulic lines from the control valve.

d. Disconnect the yokes connecting the control lever linkage to the control valve by removing the nuts and clevis pins (refer to fig. 3-14).

e. Remove the control valve from the truck by removing the control valve mounting nuts and washers.

f. Thoroughly clean the exterior of the control valve with cleaning compound, solvent (Fed. Spec. P-D-680).

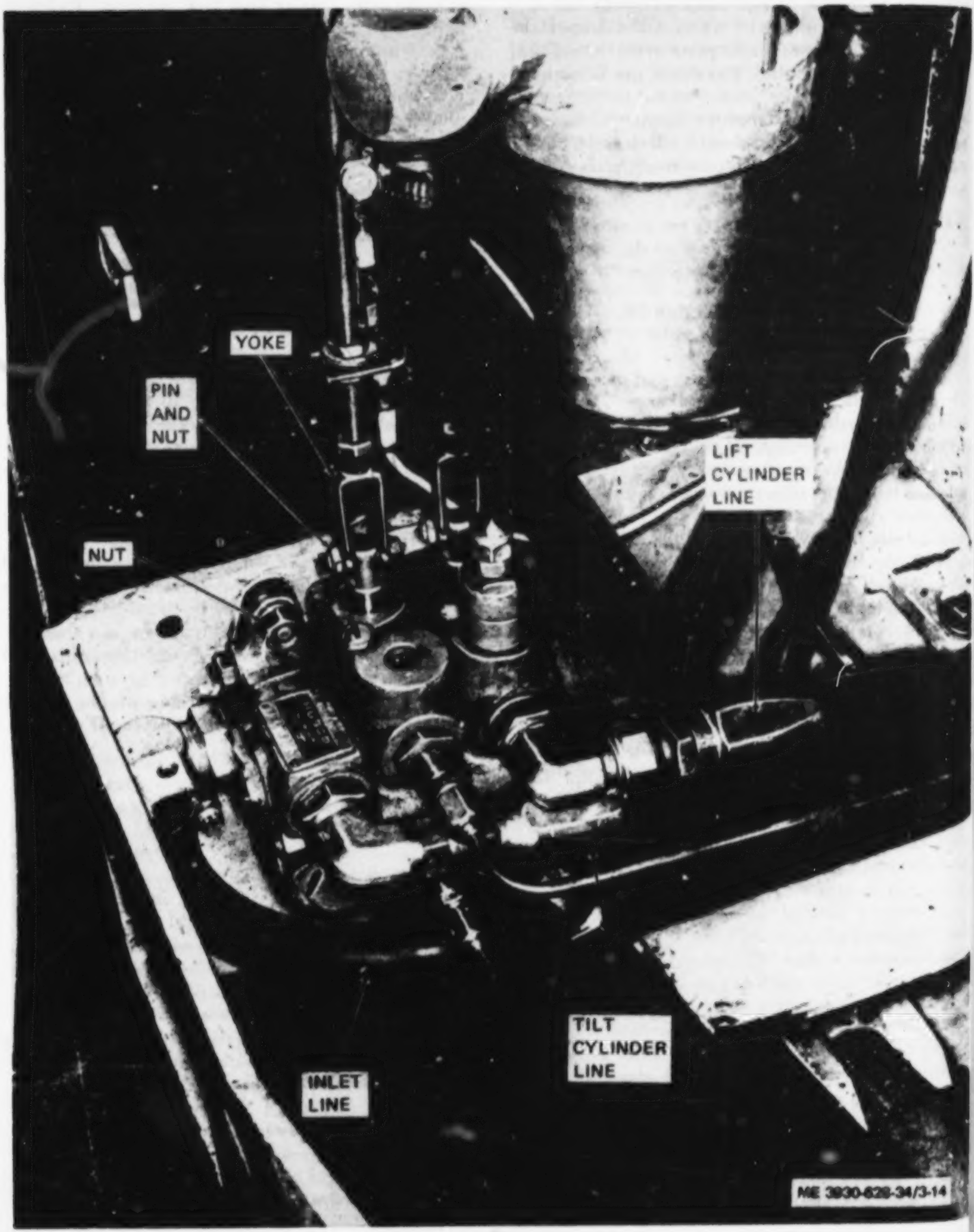
YOKE
PIN AND NUT
NUT
LIFT CYLINDER LINE
TILT CYLINDER LINE
INLET LINE
ME 3930-628-34/3-14

Figure 3-14. Control valve removal.

3-45. Disassembly

Caution: **It is extremely important that all parts be kept clean at all times, and that all machined surfaces be protected from nicks, scoring, gouging, and other damage.**

a. Disassembly of the Inlet Section. Refer to figure 3-15 and disassemble the inlet section as follows:

(1) Remove the acorn nut (1), jam nut (3) and copper washer (2) from relief valve assembly.

(2) Turn the relief valve assembly (items 1 through 18) out of the inlet housing (24). Flats are provided on the cap (17) to remove the relief valve assembly.

(3) Remove the adjusting screw (4), spring (5), poppet "E" (6), preformed packings (8, 10 and 14) and back-up rings (9 and 15) from the plug (7). Count and record the number of turns required to remove the adjusting screw (4).

(4) Remove the poppet "K" (16) from the cap (17).

(5) Remove nuts (19) and lift inlet section (24) off the tie rods (65) and remove packing (25).

(6) Remove plugs (20 and 22) and packings (21 and 23) from inlet section housing (24).

b. Disassembly of Tilt Plunger Section.

(1) Remove the screws (29, fig. 3-15) securing the seal plate (30) to the plunger end of the tilt section (28); remove the seal plate (30).

(2) Remove the screws (76), plunger cap (77) and seal plate (82) at the opposite end of the housing and pull plunger (33) from the housing.

(3) Remove the wiper ring (31) and packing (32) from the plunger end of the tilt plunger section (28). Be sure to identify from which end the ring and packing were removed.

(4) Remove the special screw (78), plunger spring (80), spring seats (81 and 79), wiper ring (83) and packing (84) from plunger (33). The plunger must be identified with the correct plunger section. The intermixing of plungers will result in incorrect clearance and possible binding or sticking of plungers.

(5) Remove the plug (26) and packing (27) from the tilt plunger housing (28).

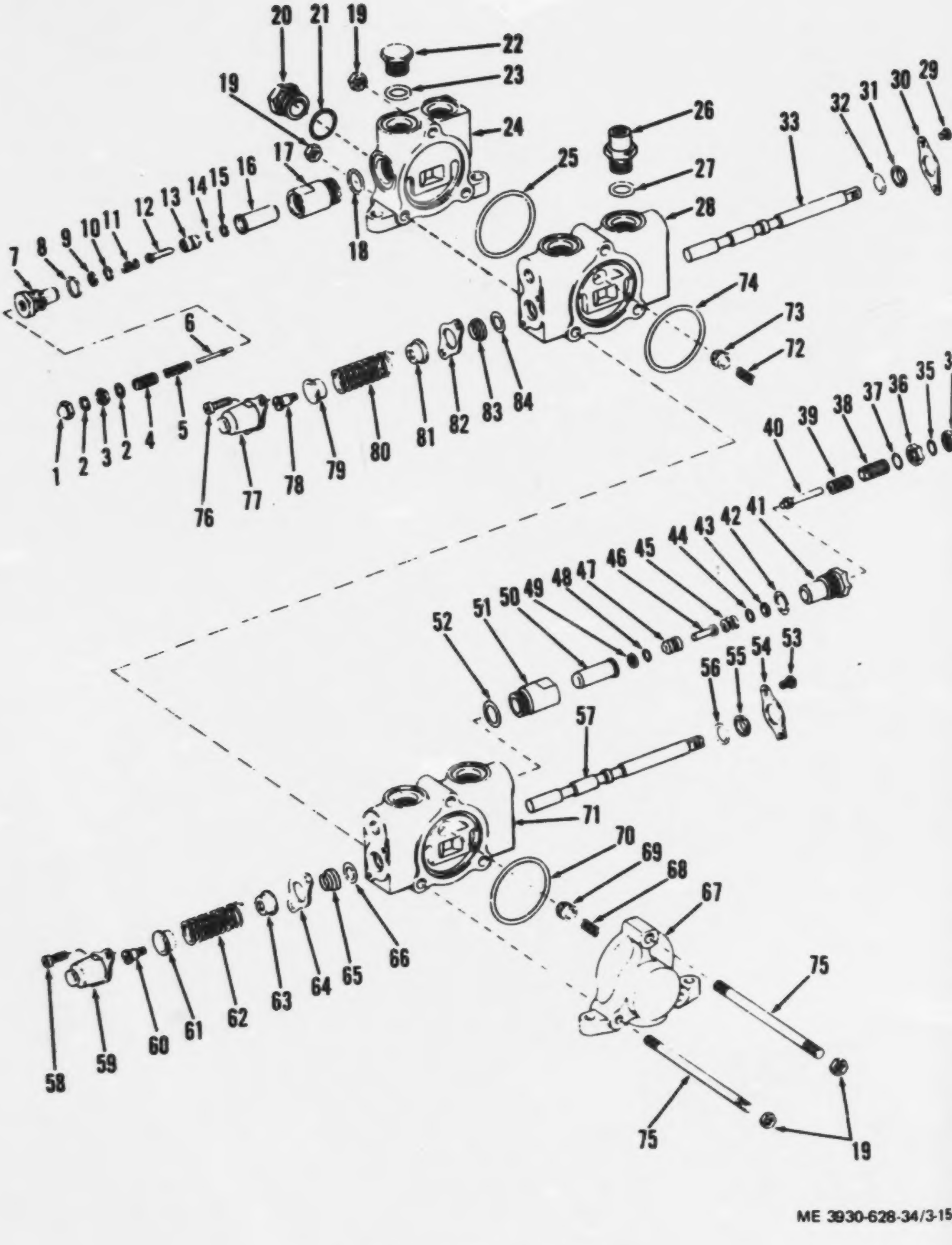
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Figure 3-15. Control valve components.

KEY to fig. 3-15:

1. Acorn nut
2. Washer
3. Jam nut
4. Adjusting screw
5. Spring
6. Poppet "E"
7. Plug
8. Packing
9. Back-up ring
10. Packing
11. Spring
12. Piston
13. Poppet "D"
14. Packing
15. Back-up ring
16. Poppet "K"
17. Cap
18. Packing
19. Nut
20. Plug
21. Packing
22. Plug
23. Packing
24. Inlet section housing
25. Packing
26. Plug
27. Packing
28. Tilt plunger housing
29. Screw
30. Seal plate
31. Wiper
32. Packing
33. Plunger
34. Acorn nut
35. Washer
36. Jam nut
37. Washer
38. Adjusting screw
39. Spring
40. Poppet "E"
41. Plug
42. Packing
43. Back-up ring
44. Packing
45. Spring
46. Piston
47. Poppet "D"
48. Packing
49. Back-up ring
50. Poppet "K"
51. Cap
52. Packing
53. Screw
54. Seal plate
55. Wiper
56. Packing
57. Plunger
58. Screw
59. Cap
60. Special screw
61. Spring seat
62. Spring
63. Spring seat
64. Seal plate
65. Wiper
66. Packing
67. Outlet section
68. Spring
69. Poppet
70. Packing
71. Lift plunger housing
72. Spring
73. Poppet
74. Packing
75. Tie rod
76. Screw
77. Cap
78. Special screw
79. Spring seat
80. Spring
81. Spring seat
82. Seal plate
83. Wiper
84. Packing

(6) Slide the tilt plunger section (28) from the tie rods (75). Remove the spring (72), poppet (73) and packing (74) from tilt plunger section (28).

c. Disassembly of Lift Plunger Section.

(1) Disassembly of the relief valve in the lift plunger housing (71) is identical to *a* above.

(2) Removal of the lift plunger section components is identical to *b* above for all parts associated with plunger action.

d. Disassembly of the Outlet Section. There are no removable parts to the outlet section (67).

3-46. Cleaning and Repair

a. Clean all parts with compound, solvent (Fed Spec P-D-680).

b. Inspect the springs for cracks, wear, deformation, or other signs of weakness.

c. Inspect all seals for cracks, cuts or other damage.

d. Inspect all machined surfaces for nicks, scratches, gouges, or other damage which would cause internal or external leakage.

e. Inspect all housings for cracks, stripped threads or other damage which could effect operation.

f. Inspect plungers and plunger bores for scoring, nicks, chips, cracks, or other damage which could result in internal or external leaks.

g. Replace seals and defective parts as authorized.

3-47. Assembly

a. Prior to reassembling the control valve parts, lubricate each part with clean hydraulic oil.

b. Assembly of the Outlet Section. There are no parts to be reassembled in the outlet section.

c. Assembly of the Lift Plunger Section. Refer to figure 3-15 and assemble the lift plunger section as follows:

(1) Install packing (14) and back-up ring (15)

on poppet "D" (13). Packing is installed on top of back-up ring.

(2) Place poppet "D' (13) in poppet "K" (16).

(3) Position the piston (12) and spring (11) in poppet "D" and "K" assembly. The piston (12) is installed first.

(4) Place poppet "E" (6) and spring (5) in the plug (7). Secure the poppet (6) and spring (5) in place with the adjusting screw (4). Turn the screw in the same number of turns required for removal.

(5) Install the back-up ring (9) and packings (10) on the plug (7). The back-up ring is positioned towards the adjusting screw end of the plug.

(6) Install the packing (8) on the plug (7) and assemble the plug and cap assembly to complete the relief valve. Secure the relief valve in the lift plunger housing (71).

(7) Install the wiper (65) and packing (66) on the spring end of the plunger (57). Position the seal plate (64), spring seats (63) and (61) and spring (62) on the plunger (57) and secure with the special screw (60).

(8) Slide the plunger assembly into the housing bore and coat the spring with a light coat of multi-purpose grease. Position the plunger cap (59) over the spring end of the plunger and secure to the lift plunger housing (71) with screws (58).

(9) Install packing (56) and wiper (55) on the linkage end of the plunger (57). Secure seal plate (54) to lift plunger housing (71) with screws (53).

(10) Install packing (70), poppet (69) and spring (68) into the plunger housing.

d. Assembly of the Tilt Plunger Section. Refer to figure 3-15 and assemble the tilt plunger section as follows:

(1) Install the plug (26) and packing (27) into the tilt plunger housing (28).

(2) Repeat steps *b*(9) through *b*(12) above, to install the tilt plunger into the tilt plunger housing.

e. Assembly of the Inlet Section. Refer to figure 3-15 and assemble the inlet section as follows:

(1) Install the plugs (20 and 22) and packings (21 and 23) in the inlet section housing (24).

(2) Assemble and install the relief valve, as directed in steps *b*(1) through *b*(8) above, into the inlet section housing (24).

(3) Install packing (25) in the inlet section housing (24).

f. Position the inlet (24), lift (71), tilt (28), and outlet (67) sections together. Be sure that the packings, poppets and springs remain in place.

g. Connect the control valve sections together with the tie rods (75). Install the nuts (19) on each end of the tie rods (75) and tighten the ⅜ inch nuts to a torque of 33 foot-pounds and the 5/16 inch nuts to a torque of 14 foot-pounds.

h. Tape the openings on the control valve to avoid the entry of contaminants while installing t control valve.

3-48. Installation.

a. Mount the control valve on center pl located in the operator's compartment (fig. 3-1

b. Remove the tape from the control valve a connect the hydraulic lines to the appropriate por

c. Connect the control handle linkage to t plungers.

3-49. Adjustment

a. Lift Plunger Section Relief Adjustment.

(1) Connect a pressure gage in the hydraulic li between the control valve and the outlet port of t primary hydraulic pump. Pressure gage must calibrated to at least 2500 psi. Refer to figure 3-1

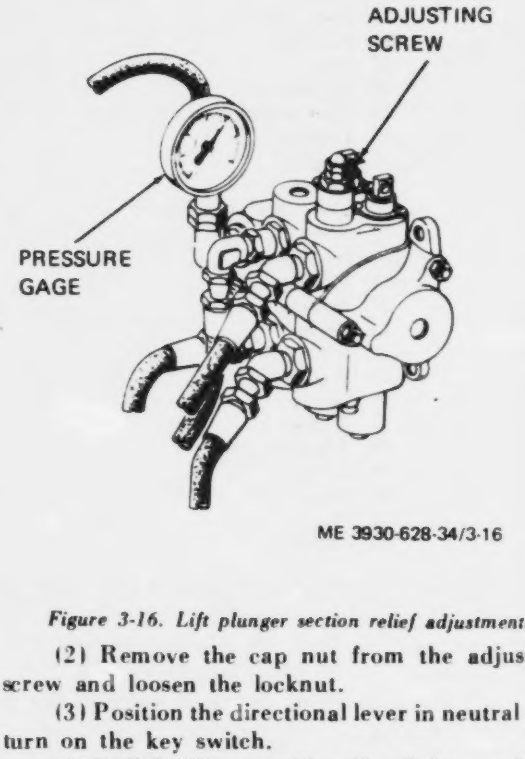


Figure 3-16. Lift plunger section relief adjustment.

(2) Remove the cap nut from the adjusti screw and loosen the locknut.

(3) Position the directional lever in neutral a turn on the key switch.

(4) Pull the lift control handle all the way ba and hold in wide open position.

(5) Turn the adjusting screw in or out until 1900 psi reading is registered on the pressure ga

(6) Lock the adjusting screw in position wi the locknut. Check the relief valve setting with capacity load on the forks before gage is remov

(7) Turn the key switch OFF and dischar the capacitors.

(8) Install the cap nut, remove the press gage and reconnect the hydraulic line.

b. Inlet Section Relief Valve.

(1) Remove the plug in elbow in hydrau

control valve and connect a pressure gage in the elbow between the secondary outlet port of the hydraulic pump and the inlet port of the inlet section. Refer to figure 3-17.

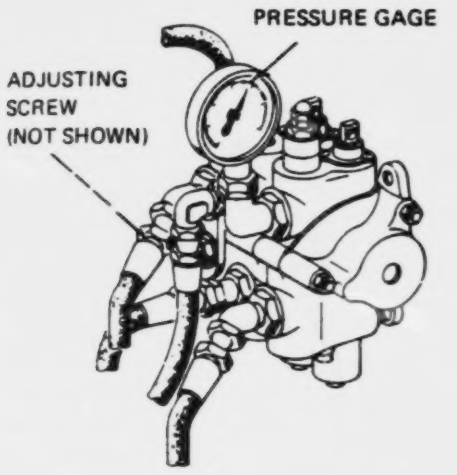


Figure 3-17. Inlet section relief adjustment.

(2) Repeat steps (1), (2) and (3) above.

(3) Pull or push the tilt control handle all the way backward or forward and hold in position.

(4) Turn the adjusting screw in or out until a 2100 psi reading is registered on the pressure gauge.

(5) Lock the adjusting screw in position and tighten the locknut.

(6) Place a capacity load on forks and tilt the mast all the way back. Relief valve should unseat at 2100 psi. A deflection in the gauge reading should be noticed.

(7) Turn the key switch OFF and discharge the capacitors.

(8) Install the cap nut, remove the pressure gauge and reconnect the hydraulic lines.

(9) Install the floor plate and control valve cover.

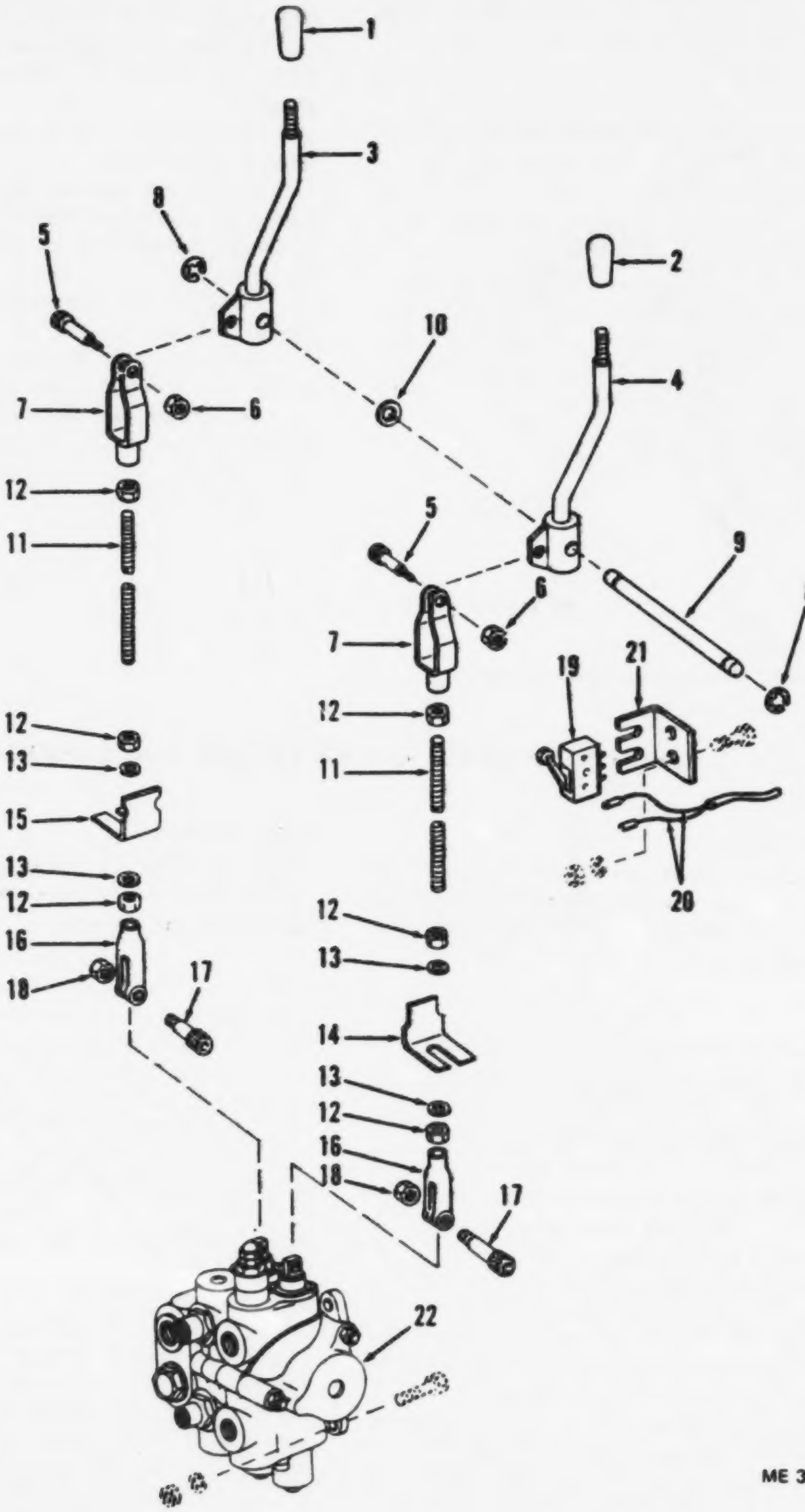
Section X. CONTROL VALVE LEVERS AND LINKAGE

3-50. Description

The lift and tilt hydraulic system control levers are located in the operator's compartment. They operate lift and tilt plungers in the hydraulic control valve.

3-51. Removal

Refer to TM 10-3930-628-12 to remove and disassemble the linkage and switch. Figure 3-18 illustrates the linkage.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ME 3930-628-34/3-1

Figure 3-18. Control valve and linkage.

KEY to fig. 3-18:

1. Knob, tilt
2. Knob, lift
3. Lever, tilt
4. Lever, lift
5. Screw
6. Nut
7. Yoke
8. Retaining ring
9. Shaft
10. Spacer
11. Rod
12. Nut
13. Washer
14. Actuator, lift
15. Actuator, tilt
16. Yoke
17. Screw
18. Nut
19. Switch
20. Wires
21. Bracket

3-52. Cleaning, Inspection and Replacement

a. Clean all metal parts in cleaning compound, solvent (Fed. Spec. P-D-680).

b. Check all bearing surfaces for nicks, scoring, or other damage which might cause resistance to the return spring action of the control valve.

c. Replace any defective parts as authorized.

3-53. Installation

Refer to TM 10-3930-628-12 to install the switch and linkage.

3-54. Adjustments

a. Refer to TM 10-3930-628-12 to adjust the linkage for proper operation.

b. Refer to TM 10-3930-628-12 to adjust the switch and maintain proper pump operation.

CHAPTER 4

REPAIR OF THE ELECTRICAL SYSTEM

Section I. DRIVE MOTOR

4-1. Description

The drive motor is a flange mounted type, D.C. series wound with connections brazed of high conductivity material. A replaceable armature shaft is employed, mounted on a sealed bearing at the commutator end and a double row thrust bearing at the drive end. Dual metal graphite brushes are supported in fixed box type holders to assure proper brush alignment. A metal clip on the top of each brush forms a stop device that prevents commutator scoring.

4-2. Removal

a. Removal. Refer to paragraph 2-6 and figure 4-1 and remove the drive motor (9). The differential carrier (18) and parking brake (11) are removed with the motor (9).

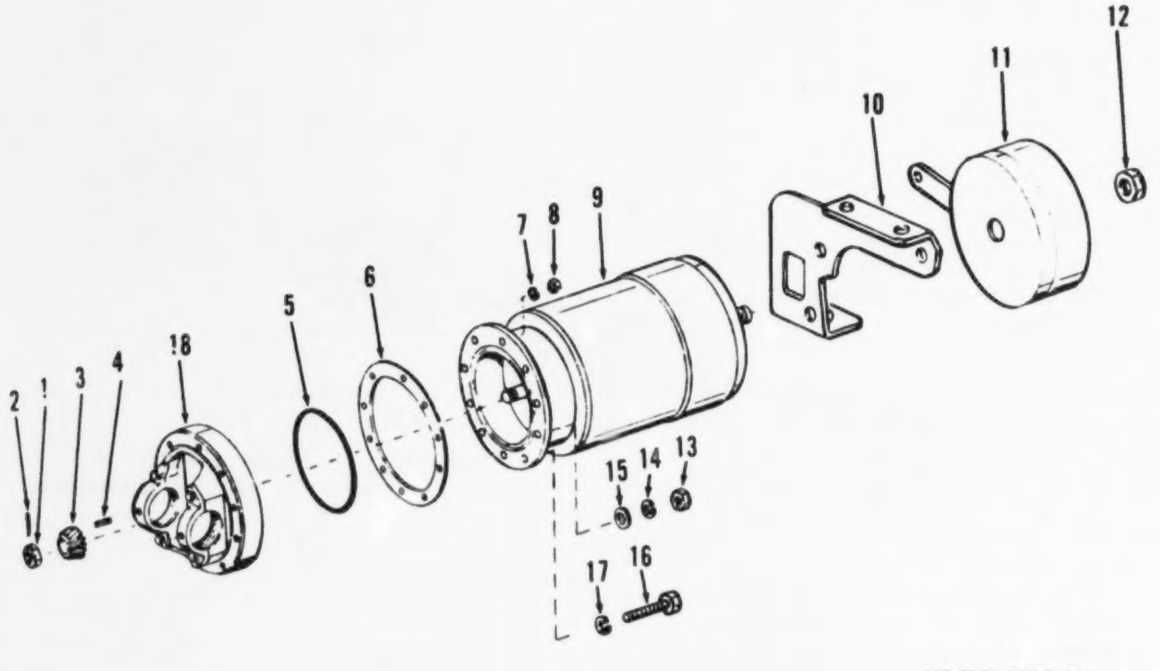
b. Removal of Components. Refer to figure 4-1 and remove parking brake and differential carrier as follows:

(1) Remove four screws (16) and lock washers (17) and remove differential carrier (18) from drive motor (9).

(2) Remove packing (5) and shims (6) from carrier. Tag and count number and thickness of shims for proper installation.

(3) Remove self-locking nut (12) and remove parking brake (11) from drive motor (9).

(4) Remove cotter pin (2) and nut (1) securing pinion (3) to shaft of motor. Remove pinion and key (4) from shaft using a suitable puller if necessary.



ME 3930-628-34/4-1

1. Nut
2. Cotter pin
3. Pinion
4. Key
5. Packing
6. Shim
7. Lock washer
8. Nut
9. Drive motor
10. Motor bracket
11. Parking brake
12. Self-locking nut
13. Nut
14. Lock washer
15. Flat washer
16. Screw
17. Lock washer
18. Differential carrier

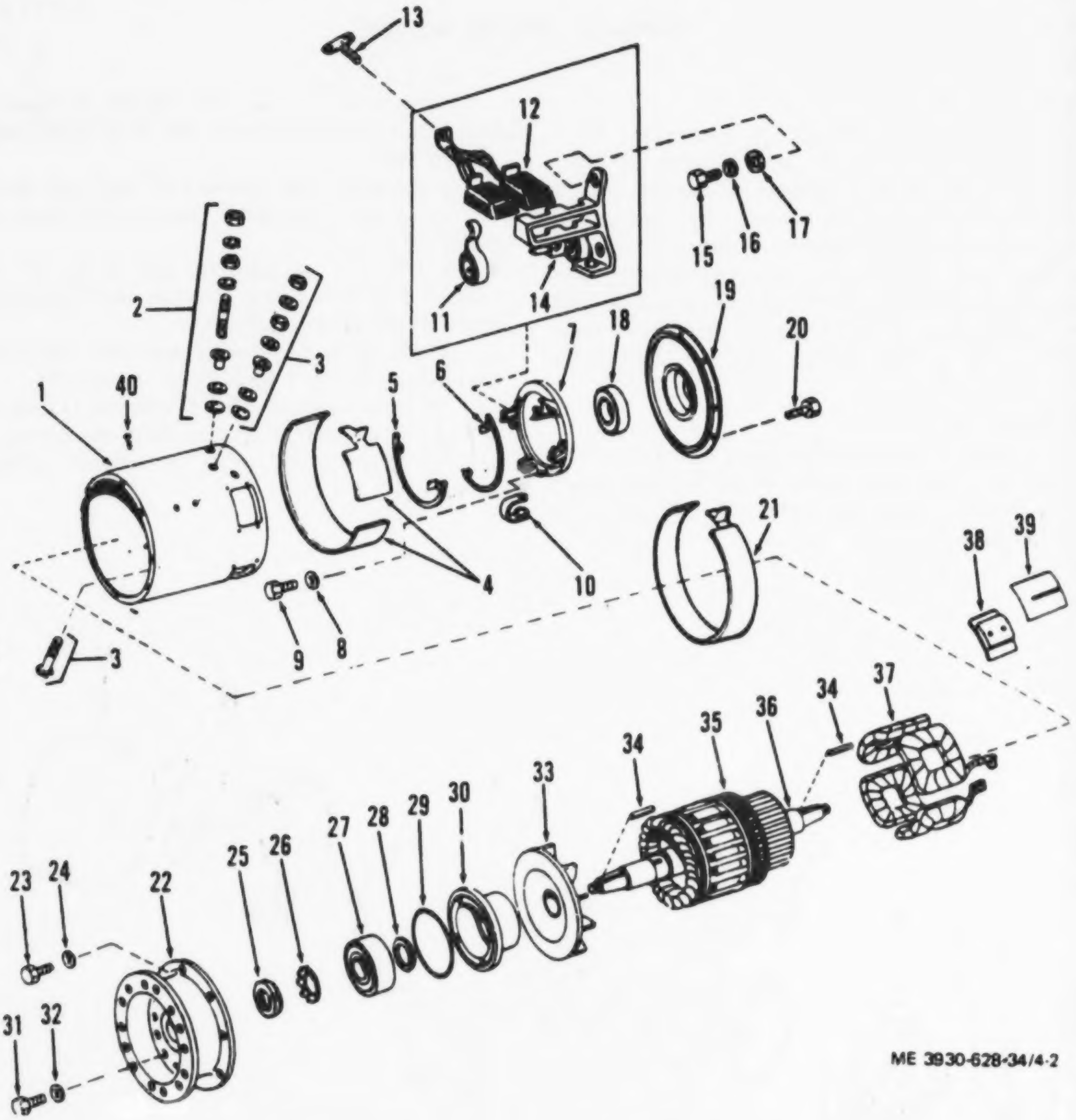
Figure 4-1. Driver motor and components, exploded view.

4-3. Disassembly

a. Clean the exterior of the drive motor with cleaning compound, solvent (Fed. Spec. P-D-680). With parking brake set, remove nut from motor shaft. Using suitable puller, remove parking brake drum.

b. Remove rear band assembly (4, fig. 4-2).

c. Remove the brush shunt retaining screws (13 lift brush retaining springs (11) and withdraw th brushes (12) from the brush holders (14).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ME 3930-628-34/4-2

1. Yoke
2. Stud assembly
3. Stud assembly
4. Rear band
5. Connector
6. Connector
7. Rocker arm assembly
8. Washer
9. Screw
10. Jumper
11. Spring
12. Brush
13. Screw
14. Brush holder
15. Screw
16. Washer
17. Lock washer
18. Bearing
19. End cover
20. Screw
21. Front band
22. Carrier
23. Screw
24. Lock washer
25. Carrier
26. Lock washer
27. Bearing
28. Oil seal
29. Packing
30. Bearing retainer
31. Screw
32. Washer
33. Fan
34. Key
35. Armature assembl
36. Armature shaft
37. Field coils
38. Pole shoes
39. Shim
40. Screw

Figure 4-2. Drive motor, exploded view.

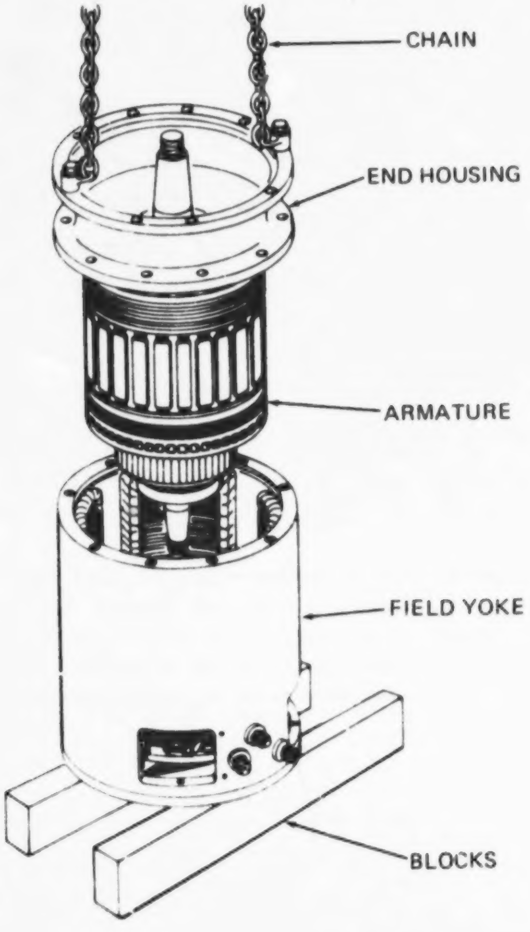
d. Place the motor on end, with the drive end up.

Caution: **Use extreme care whenever using a gear puller or damage may result to the shaft. An improper puller will flare out the shaft center, damaging threads to the extent of requiring a new armature shaft. It is recommended to use a shaft protector in conjunction with the gear puller.**

e. Remove the screws (23) and lock washers (24) securing the front housing (22) to the field yoke (1).

Caution: **Lift the armature straight up, carefully avoiding damage to the commutator or core.**

f. Attach a chain to the housing and, with a chain hoist, lift the armature and assembled parts. Refer to figure 4-3.



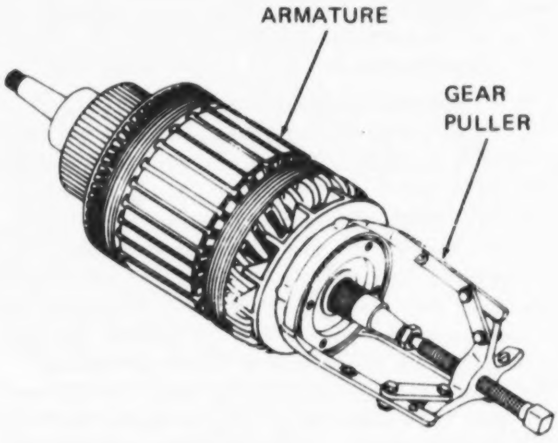
ME 3930-628-34/4-3

Figure 4-3. Armature removal.

g. Remove the screws (31, fig. 4-2) and lock washers (32) from the housing (22) and remove the housing.

h. Bend the tabs of the retainer lock washer (26) down, then using a spanner wrench, remove the locknut (25).

i. Using a gear puller, remove the bearing retainer (30) from the armature shaft. When the retainer (30) is removed, the bearing (27), oil seal (28) and packing (29) will come off with the retainer. Refer to figure 4-4. Remove the bearing and seal from the retainer.



ME 3930-628-34/4-4

Figure 4-4. Removal of bearing retainer.

Note. The bearing is of the single shield type and can be regreased. All old grease should be removed from the bearing, and then bearing should be thoroughly washed out. Check the bearing for running smoothness and replace it if any roughness is in evidence. Repack the bearing only half full with grease (GMD).

Caution: **Overgreasing bearing will cause overheating, so care must be taken to make certain that the grease cavity is packed only half full. When assembling make certain that the shield faces outward.**

j. Remove and inspect the retainer packing (29, fig. 4-2) and oil seal (28). Replace worn or damaged parts. The oil seal is a light press fit.

k. Remove and replace the commutator end bearing if worn or damaged as it is a sealed type and cannot be lubricated.

l. Remove the fan (33) by applying a steady amount of pressure against the back side of the fan.

The fan (33) is hand pressed on against a key (34), angled up on the backside to prevent the fan from being pressed on too far and causing possible damage to the armature windings.

m. Remove the end cover screws (20) and remove the end cover (19) and the rocker arm assembly (7).

***Caution:* Special care should be exercised in removing in order that damage to the insulation on the field coil be avoided.**

n. Field coils (37) should not be removed unless replacement is required. To remove, loosen slotted screws (40) securing the pole shoes (38) to the yoke (1), remove the shims (39) from behind the pole shoes (38), noting quantity and location of the shims and remove the screws (40), pole shoes (38) and coils (37).

4-4. Cleaning and Inspection

a. Clean all parts except the armature and field coils with cleaning compound, solvent (Fed. Spec. P-D-680).

b. Inspect the armature as follows:

(1) Inspect the armature for grounds with a test light by touching one of the test probes to the armature core and the other probe to one of the commutator riser bars (fig. 4-5). Test all commutator bars in this manner. If the test light glows, the armature is grounded and must be replaced.

Note. The armature that is shown in figures 4-5, 4-6 and 4-7 is not to be confused as being that which is used in the drive or pump motors. It is for illustrative purposes only.

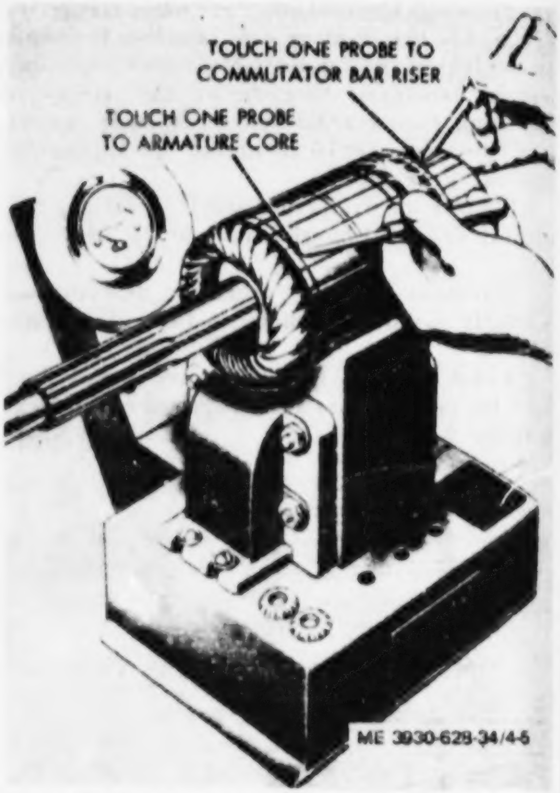

TOUCH ONE PROBE TO COMMUTATOR BAR RISER
TOUCH ONE PROBE TO ARMATURE CORE
ME 3930-628-34/4-5

Figure 4-5. Testing the armature for grounds.

(2) Inspect the armature for short circuits using a growler fixture. Place the armature in the growler as shown in figure 4-6. Hold a thin strip of steel, such as a hacksaw blade, about 1 / 32 inch from the armature. While holding the steel strip in this position, rotate the armature slowly in the growler. A short circuit will pull the steel strip tightly against the armature core and cause the strip to vibrate. If a short circuit is found, the armature must be replaced.

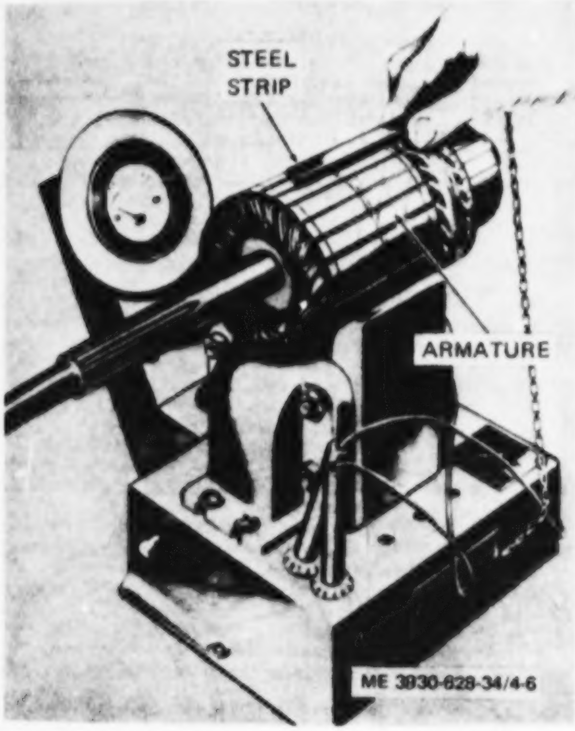


Figure 4-6. Testing the armature for short circuits.

(3) Inspect the armature shaft and commutator for runout using a lathe or "V" blocks and a dial indicator (fig. 4-7). If runout exists, the commutator must be resurfaced until true.

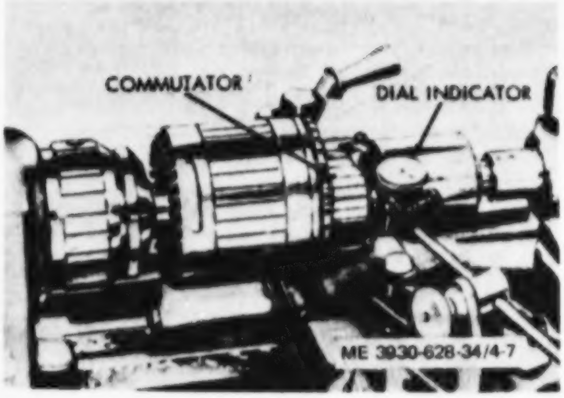


Figure 4-7. Checking commutator runout.

(4) Inspect the commutator contact surface. A satisfactory condition is indicated by an even, highly burnished, dark-copper color. If the contact surface is rough, pitted, scored, burned, or coated with hard carbon or oil, the commutator must be resurfaced. If the mica insulation between the commutator bars is not 0.025 to 0.032 inch below the surface of the bars, it must be undercut to the correct depth.

c. Inspect the field coils for grounds by placing one probe of a test lamp (fig. 4-8) on the field yoke and the other probe on the field terminal. If the lamp lights, the field coils are grounded and must be replaced if the ground cannot be located and repaired.

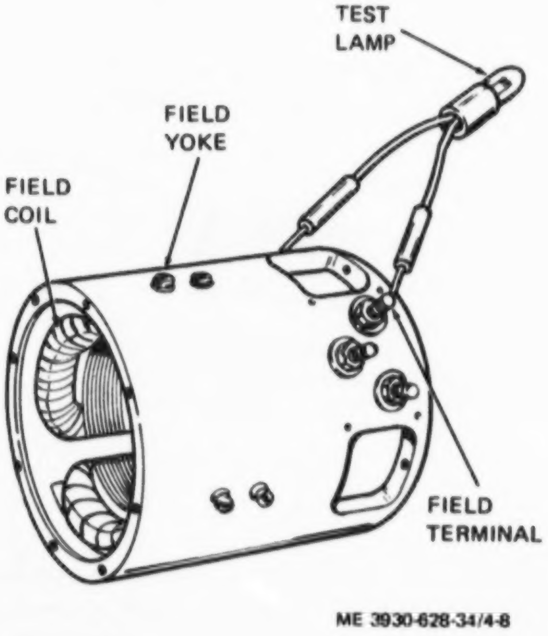


Figure 4-8. Testing field coil for grounds.

d. Inspect the field yoke for cracks and distortion; replace if defective.

e. Inspect the brush holder and brushes as follows:

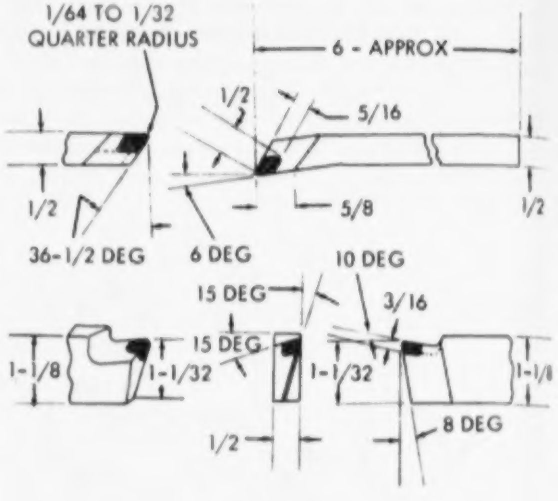
(1) Check the insulation and brush holder for distortion and cracks.

(2) Refer to paragraph 5-6*b*(1) for brush spring tension limits.

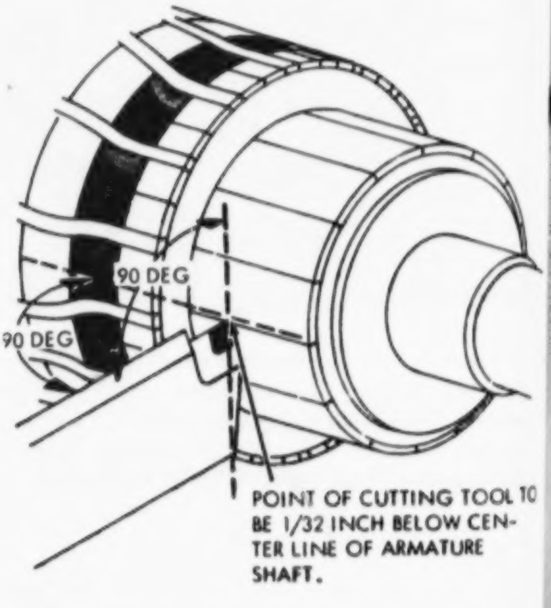
4-5. Repair

a. Repair of the Armature.

(1) *Resurfacing.* Sharpen the lathe cutting tool to the dimensions given in figure 4-9. After grinding, hone the tool with a fine hard stone to ensure a smooth cut during the turning operations. Position the tool with respect to the commutator as shown in figure 4-9. Resurface the commutator at 800 rpm taking only light cuts each time. No more than 0.005 inch should be removed during any one cut and the final cut should not be more than 0.002 inch. After resurfacing, check against specified wear limits and undercut the mica insulation ((2) below) if refinished commutator is within the limits specified. Minimum outside diameter of commutator is 4.375 inches. Replace the armature if it does not conform.


1/64 TO 1/32
QUARTER RADIUS
6 - APPROX
1/2
5/16
1/2
5/8
1/2
1/2
36-1/2 DEG
6 DEG
10 DEG
15 DEG
3/16
15 DEG
1-1/8
1-1/32
1-1/32
1-1/8
1/2
8 DEG

A. Cutting tool sharpening dimensions


90 DEG
90 DEG
POINT OF CUTTING TOOL TO BE 1/32 INCH BELOW CENTER LINE OF ARMATURE SHAFT.

B. Proper position of cutting tool

ME 3930-628-34/49

Figure 4-9. Cutting tool dimensions and positioning.

(2) *Undercutting mica.* After resurfacing the commutator, undercut the mica to a depth of 0.025 to 0.032 inch below the commutator surface using a power-driven undercutting tool (fig. 4-10). If a power-driven tool is not available, the mica may be undercut by hand as shown in figure 4-11.

Note. Use care in undercutting. Do not widen the commutator slots by removing metal from the segments, and do not leave a thin edge of mica next to the segments. Figure 4-11 illustrates good examples of good and bad undercutting.

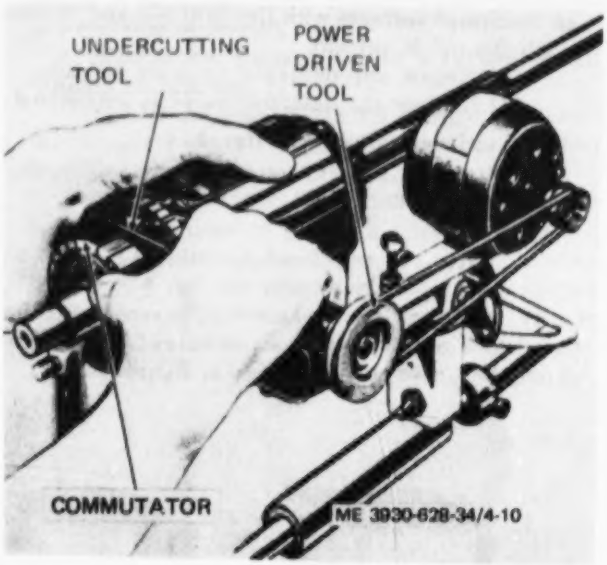

UNDERCUTTING TOOL
POWER DRIVEN TOOL
COMMUTATOR
ME 3930-628-34/4-10

Figure 4-10. Undercutting mica using a power-driven tool.

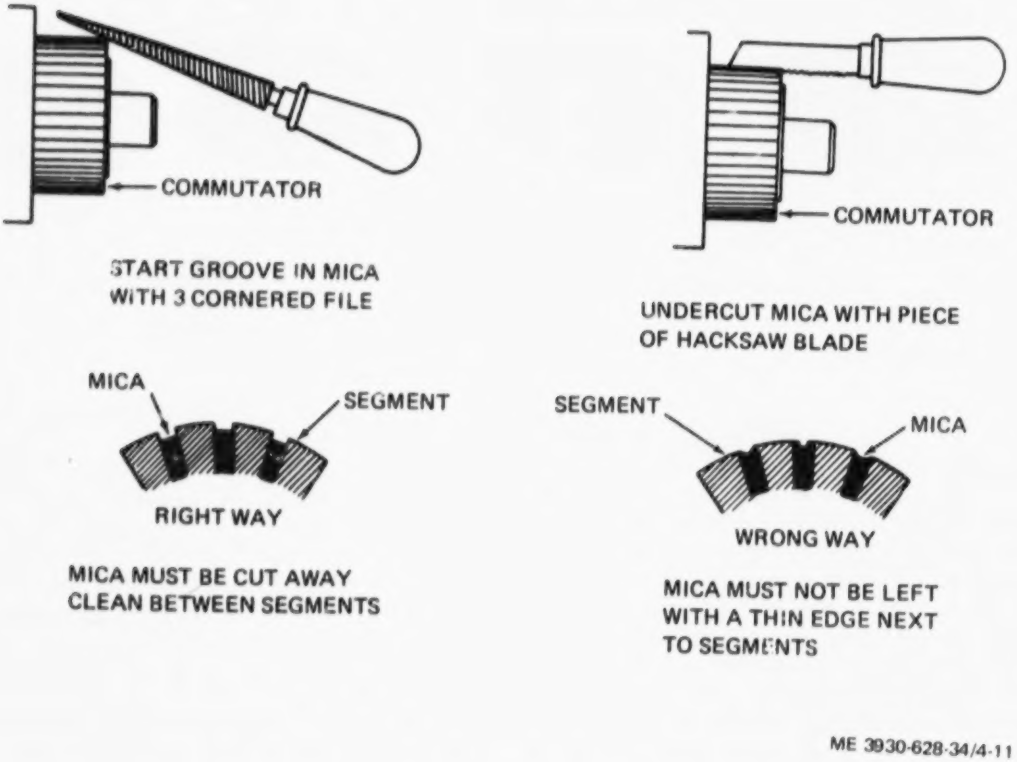

COMMUTATOR
START GROOVE IN MICA WITH 3 CORNERED FILE
COMMUTATOR
UNDERCUT MICA WITH PIECE OF HACKSAW BLADE
MICA
SEGMENT
RIGHT WAY
MICA MUST BE CUT AWAY CLEAN BETWEEN SEGMENTS
SEGMENT
MICA
WRONG WAY
MICA MUST NOT BE LEFT WITH A THIN EDGE NEXT TO SEGMENTS
ME 3930-628-34/4-11

Figure 4-11. Undercutting mica using an alternate hand method.

(3) *Polishing the commutator.* After the mica has been undercut, remove all copper and mica particles with compressed air. Polish the commutator in a lathe with No. 2 / 0 sandpaper while the armature is rotating at a speed of 1500 rpm.

b. Repair of the Remaining Parts.

(1) Smooth minor scratches, burrs, and nicks on machined surfaces with fine mill file and crocus cloth dipped in solvent.

(2) Repair any damaged or worn threads.

(3) Replace any defective parts as authorized.

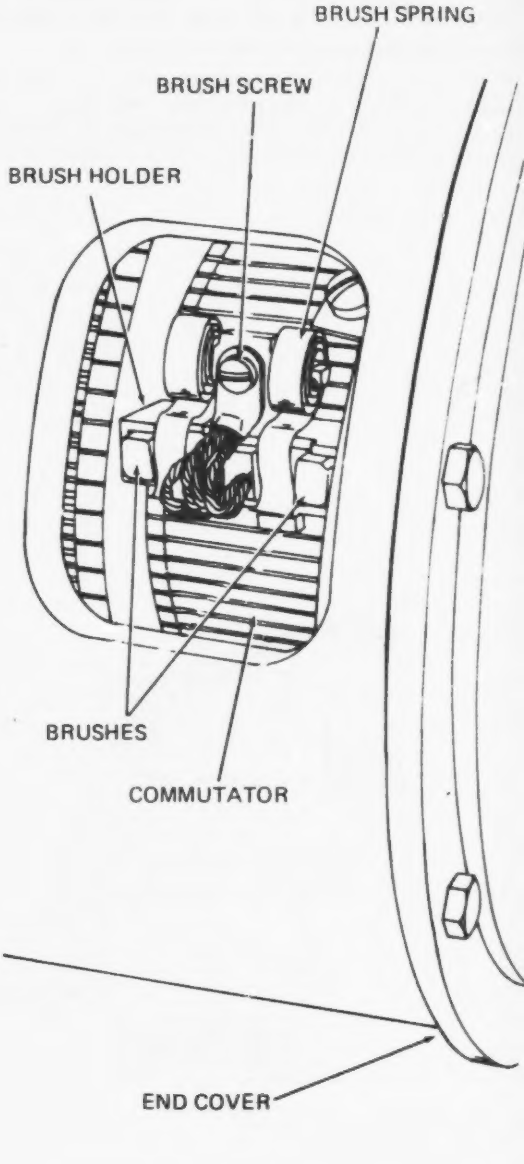
4-6. Replacement of the Brushes

Note. The brushes may be replaced without removing the drive motor from the truck.

a. *Removal.*

(1) Remove rear band assembly (4, fig. 4-2) from around the field yoke (1, fig. 4-2).

(2) Remove the brush retaining screw; lift the brush retaining springs and withdraw the brushes from the brush holder. Refer to figure 4-12.


BRUSH SPRING
BRUSH SCREW
BRUSH HOLDER
BRUSHES
COMMUTATOR
END COVER

ME 3930-628-34/4-12

Figure 4-12. Brush location.

b. Inspection and Brush Seating.

(1) Inspect the brushes for excessive wear, cracks, or other damage. Minimum height for useable brushes is 0.5625 inch. Replace if necessary. Inspect the brush springs for cracks, deformation or loss of tension. The correct spring tension is 40 ounces for the drive motor and 25 ounces for the pump motor.

(2) Seating of the brushes on the commutator is extremely important. Before the new brushes are installed, they should be contoured on a sanding drum with the same diameter as the commutator. Hold the brushes to the sanding drum to obtain the same radius and brush angle on the contact face as was on the old brushes. Final seating can be obtained with a fine mesh seating stone while the commutator is turning.

c. Installation. Refer to figure 4-12 and install brushes as follows:

(1) Lift the brush retaining springs and insert the brushes; install the brush retaining screw. Brush surface must seat flat on commutator.

(2) Slowly rotate the armature by hand for several revolutions to properly seat the brushes.

(3) Lift the brush springs and raise each brush and inspect the seat contour to determine whether or not the sanding operation is satisfactory. Refer to figure 4-13 for examples of satisfactory brush seats. Repeat step *b* (2) above if necessary.

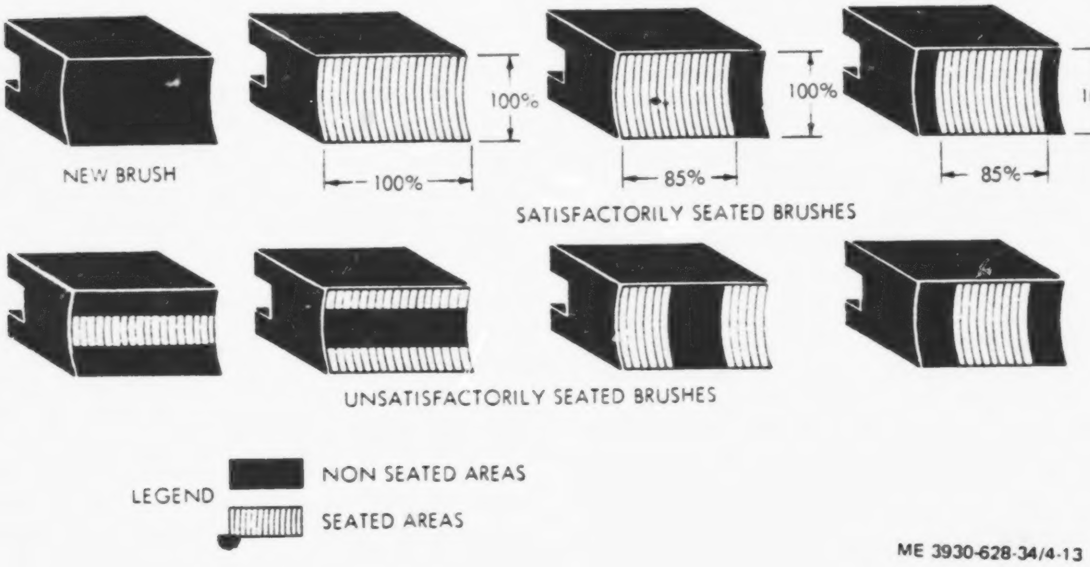


Figure 4-13. Examples of satisfactory and unsatisfactory brush seats.

4-7. Assembly

Caution: Care should be taken to avoid damage to the insulation on the field coils.

a. Install the field coils (37, fig. 4-2) and pole shoes (38) in the yoke (1). Install the shims (39) between the pole shoes (38) and the yoke (1), being certain that the quantity of shims and the location of the shims is the same as they were prior to removal. Secure in place with screws (40).

b. Install the brush holders (14) on the rocker arm (7) with the screws (15), washers (17) and lock washers (16). Install the springs (11) on the brush holders (14).

Note. The brushes shall not be installed at this time.

c. Secure the rocker arm assembly (7) to the end cover (19) with screws (9), washers (8). Install the end cover (19) and rocker arm (7) assemblies on the yoke (1) with screws (20).

d. Install key (34) in shaft. Carefully install the fan (33) on the armature shaft and key, with fan angle towards armature winding. The exertion of hand pressure on the fan blade is all that is necessary to force it onto the armature shaft.

e. Install the commutator end bearing (18) onto the armature shaft. Install new packing (29) and the oil seal (28) into the bearing retainer (30). The oil seal is a light press fit.

f. Install the bearing retainer (30) and bearing (27) on the armature shaft; secure in place with the lock washer (26) and lock nut (25).

g. Install the housing (22) and secure it to the bearing retainer (30) with screws (31) and washers (32).

h. Place the yoke assembly (1) on end and carefully install the armature assembly into the yoke. Refer to figure 4-3. Secure in place with screws (23) and washers (24).

i. Install the brushes (12) in the brush holders (14) and install the shunt retaining screws (13). Replace the rear band assembly (4) on the yoke (1).

j. Install the parking brake assembly (11, fig. 4-1) on the drive motor and secure in place with self-locking nut (12).

4-8. Installation

a. Install key (4, fig. 4-1) and pinion (3) on motor shaft. Secure pinion on shaft with nut (1).

b. Torque tighten nut to 75-85 foot-pounds and secure nut with cotter pin (2).

c. Install packing (5) in groove in motor flange. Install shims (6) between motor and differential carrier (18).

d. Secure motor to differential carrier with screws (16) and lock washers (17).

e. Refer to paragraph 2-6 and install drive motor on truck.

f. Refer to TM 10-3930-628-12 and install thermal relay on motor.

Section II. HYDRAULIC PUMP MOTOR

4-9. Description

The hydraulic pump motor is a ventilated, sealed ball bearing type motor. It is series wound for uniform motor speed, maximum pump life and smooth hydraulic control. The pump motor is supported on each end by mounting brackets which are secured to the truck frame. The motor is activated through microswitches whenever the ignition switch is in the "ON" position and the lift or tilt handles are operated.

4-10. Removal

a. Refer to paragraph 2-7 to remove pump and motor from truck.

b. The motor can be removed from truck without disturbing pump and hydraulic system as follows:

(1) Remove floor and toe plates and remove drip pan. Raise truck sufficiently to allow room to work beneath truck. Block truck to hold in position.

(2) Remove two screws and lock washers securing hydraulic pump to motor.

(3) Separate pump from motor and move pump to side, leaving hoses attached to pump.

(4) Tag and disconnect cables from motor. Disconnect and remove thermal relay from motor.

(5) Remove screws securing motor mounting brackets to truck frame. Remove motor with attached brackets.

4-11. Disassembly

a. Remove the screws (1 and 25, fig. 4-16) securing the mounting brackets (2 and 26). Remove the brackets from motor.

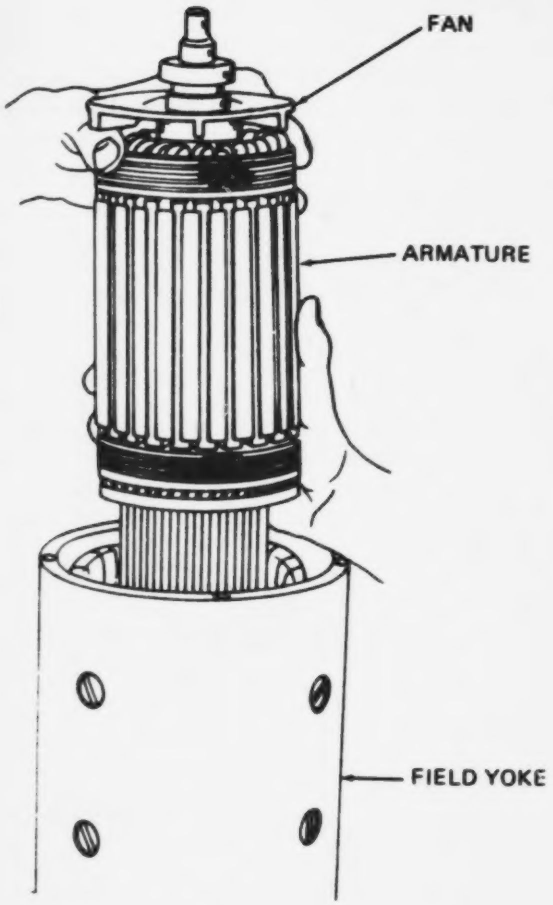
b. Remove both the front (22) and rear (6) cover assemblies from the motor.

c. Remove the brush shunt retaining screw (27), lift the brush retaining springs (30) and withdraw the brushes (31) from the brush holder (29).

d. Remove the screws (3) and washers (4) securing the rear housing (5) to the field yoke (14); remove the housing.

Caution: **Exercise extreme care when removing the armature to prevent damaging core, commutator, or pole faces. Make certain that the armature is pulled straight up out of the field yoke.**

e. Carefully remove the armature assembly as shown in figure 4-14. Remove the armature complete with bearings.

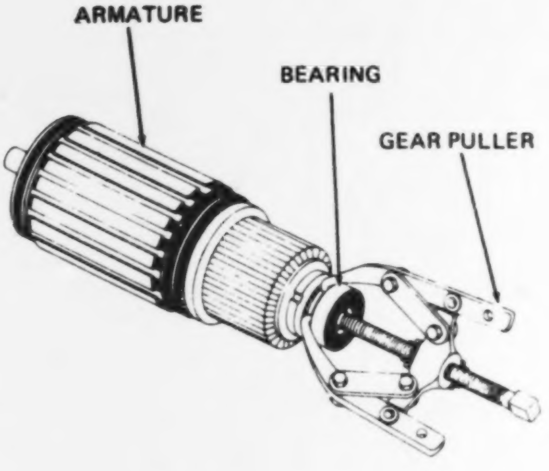


ME 3930-628-34/4-14

Figure 4-14. Armature removal.

Caution: Use extreme care when using a gear puller or the center of the shaft could be damaged. It is recommended that a shaft protector be used in conjunction with the gear puller.

f. If the bearings (7 and 12, fig. 4-16) are worn or damaged, remove the bearings from the armature shaft with a suitable puller as shown in figure 4-15.



ME 3930-628-34/4-15

Figure 4-15. Bearing removal.

g. The fan (9) is secured to the armature shaft with a Woodruff key (10) and a snap ring (8). Remove the snap ring, fan and key.

h. Remove the end cover (19) and rocker arm assembly (17) by removing screw (24) and washer (23).

Note. Disassemble the rocker arm assembly only as far as necessary to replace worn or damaged parts.

i. Refer to figure 4-16 and disassemble the rocker arm assembly as follows:

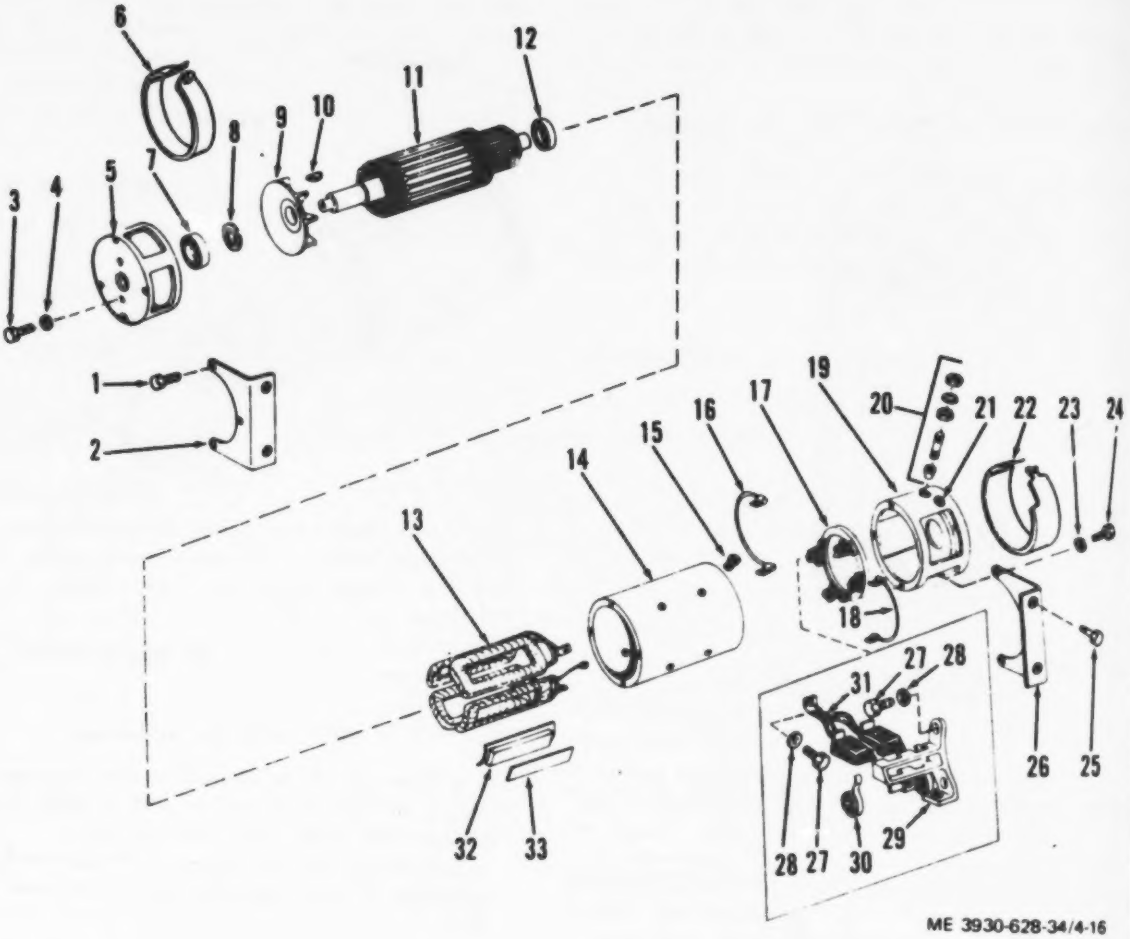
(1) Remove connectors (16 and 18) from rocker arm assembly.

(2) Remove screws (27) and washers (28) securing the brush holder (29) to the rocker arm (17).

(3) Remove the brush springs (30).

j. To remove the field coils, remove the pole retaining screws (15) and note the quantity of shims (33) behind each pole shoe.

k. Remove the pole shoe (32) from each field coil; remove the coil assembly.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26
25
29
32
33
28
27
30
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1. Screw	17. Rocker arm
2. Bracket	18. Connector
3. Socket head screw	19. Front housing
4. Washer	20. Field stud assembly
5. Rear housing	21. Armature stud assembly
6. Rear cover	22. Front cover
7. Bearing	23. Washer
8. Snap ring	24. Socket head screw
9. Fan	25. Screw
10. Woodruff key	26. Bracket
11. Armature	27. Screw
12. Bearing	28. Washer
13. Field coils	29. Brush holder
14. Field yoke	30. Brush spring
15. Screw	31. Brush
16. Connector	32. Pole shoe
	33. Shim

Figure 4-16. Hydraulic pump motor, exploded view.

4-12. Cleaning and Inspection

Clean and inspect the hydraulic pump motor as outlined in paragraph 4-4.

4-13. Repair

Repair the hydraulic pump motor as outlined in paragraph 4-5.

4-14. Replacement of the Brushes

Replace the brushes in the pump motor as outlined in paragraph 4-6.

4-15. Assembly

a. Install the pole shoe (32, fig. 4-16) and field coils (13) into the field yoke (14). Install the original quantity of shims (33) between the pole shoe (32) and the yoke (14). Secure in place with screws (15).

b. Assemble the rocker arm (17) as follows:

(1) Install the brush springs (30) on the brush holder (29).

(2) Secure the brush holder (29) to the rocker arm (17) with screw (27) and washer (28).

(3) Install the connectors (16 and 18).

c. Place the rocker arm assembly in the end cover (19). Mount the rocker arm and cover to the field yoke with screws (24) and washers (23).

d. Secure the fan (9) to the armature shaft with a snap ring (8) and Woodruff key (10).

e. Press new bearings (7 and 12) onto the armature shaft.

f. Carefully install the armature in the field yoke assembly.

g. Secure the rear housing (5) to the field yoke (14) with screws (3) and washers (4).

h. Insert the brushes (31) into the brush holder (29) by lifting the brush retaining springs (30) and sliding brushes into the brush holder. Brush surfaces seat flat on commutator. Install the brush shunt retaining screw (27).

i. Install both the front (22) and rear (6) cover assemblies on the motor.

j. Secure the mounting brackets (2 and 26) to the pump motor with screws (1 and 25).

4-16. Installation

a. Attach a chain hoist to the mast assembly and raise and block the truck to a height which will allow the hydraulic pump motor to be slid under the truck for installation.

b. Place motor on a floor jack. Carefully raise the motor into position and install the screws securing the mounting brackets to the truck frame.

c. Connect all electrical cables to the motor that were removed. Install pump on motor and secure with two screws. Install thermal relay on motor.

d. Install the floor and toe plates, and the drip pan.

Section III. DRIVE CONTROL

4-17. Description

This section presents a detailed discussion and description of the TYPE 702 MK II SYSTEM of pulse width modulation for drive control of electric fork lift trucks. The 702 MK II SYSTEM is made up of modular sections. If trouble occurs within a module, it can be traced quite easily, and the module can be repaired or replaced, resulting in a minimum downtime on the equipment. Printed circuitry is used where feasible. Heavy duty, industrial type, epoxy glass-laminate is used for the printed circuit boards. The complete circuit board and components are encased in a plastic film for protection from moisture and dirt. Contactor contacts are made of silver alloy to reduce corrosion and prolong contact life. Continual current and battery voltage monitoring circuits are incorporated to protect the truck from abuse, and to extend component service life. Pulse width modulation as used in the 702 MK II SYSTEM is a method of DC motor control. Control of speed and power is achieved by applying the full source voltage directly to the motor load in regular recurring pulses (120 per second). These pulses, part of an "on-off" switching cycle, are varied in width by positioning the speed potentiometer. The motor responds to a current which is the average of the "on" and "off" times within each cycle.

Caution: **Disconnect batteries before attempting any repair of the electrical system.**

4-18. Power Switch

a. Description. The power switch assembly (fig. 4-19), attached to a swing-out door located on the left side of the truck frame, consists of germanium power transistors, drive transistors and related circuitry. The transistors are mounted on heat sinks that carry off the small amount of heat generated while the transistors are switching. The power switch circuitry (with the exception of the diode bias block mounted on the front of the assembly and the ceramic resistors connection power transistor heat sinks) is mounted on heavy duty industrial type epoxy, glass-laminate printed circuit boards. Each printed circuit board contains two parallel connected power transistors, two parallel connected driver transistors, and their related circuitry to form a module. These power switch modules are then parallel connected to each other by means of bus bars. This truck is equipped with eight modules.

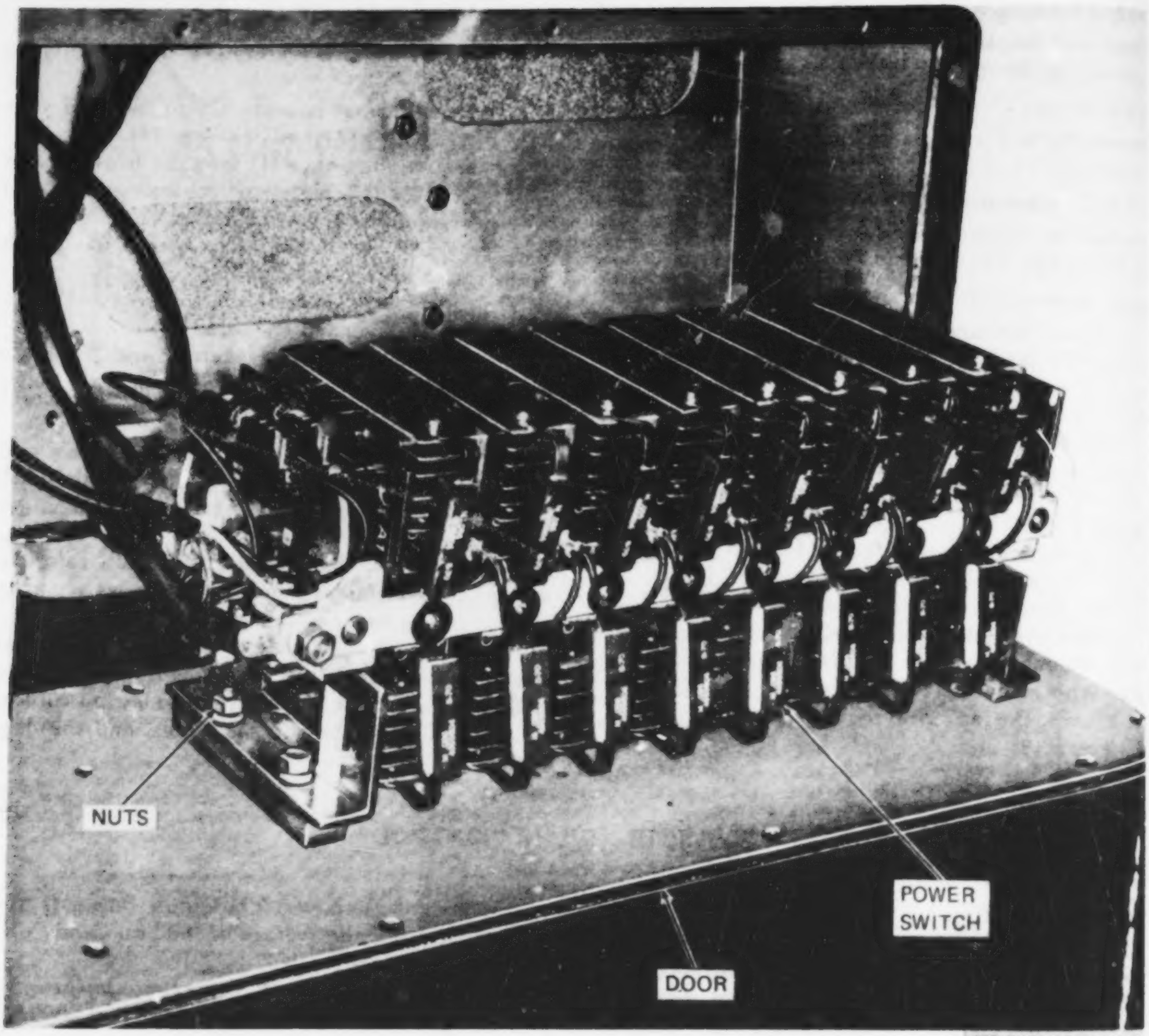

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Figure 4-17. Power switch removal.

b. Removal. Refer to figure 4-17 and remove power switch as follows:

(1) Remove the screws holding the door closed; pull out on the door and swing open.

(2) Remove and tag all electrical leads.

(3) Remove the screws, washers and nuts securing the power switch to the door; remove the power switch assembly.

c. Resistance Test. Refer to figure 4-21 to test resistance in power switch.

(1) A complete power switch assembly can be checked for collector to emitter shorts with a voltohmmeter. Set VOM on RX1 scale, connect positive lead to A1 and negative lead to B2+ of power switch assembly. A good power switch will read approximately 70 ohms. Zero ohms indicates one or more shorted transistors within the power switch assembly.

(2) To find shorted transistors, remove screw (2) attaching resistor (1) to power transistor heat sink (6), in each module, one at a time. When resistor associated with shorted transistor is removed from heat sink, resistance reading on VOM will return to normal. Touch each disconnected resistor (one at a time) to its respective heat sink. Any momentary connection which causes a zero ohm reading on VOM indicates a shorted power transistor in that module.

(3) An open between collector and emitter of power transistor can be located by disassembly of

power switch modules to allow individual transistor checking. The following ohmmeter test of power and drive transistors will determine an open or shorted condition. Leakage must be checked with a transistor checker. Refer to table 4-1. Figure 4-20 illustrates transistor and diode characteristics and test points.

Table 4-1. Transistor and Diode Resistance Checks

VOM CONNECTIONS (RX1 SCALE)

Positive red	*Negative (black)*	*Readings*
	TRANSISTORS	
Collector	Emitter	30 ohms or higher
Emitter	Collector	30 ohms or higher
Emitter	Base	12 ohms or less
Base	Emitter	Infinity
Collector	Base	12 ohms or less
Base	Collector	Infinity
	DIODES	
Anode	Cathode	X (see NOTE)
Cathode	Anode	10X (see NOTE)

Note: There must be approximately a 10 to 1 ratio between these readings to ensure that a diode is good.

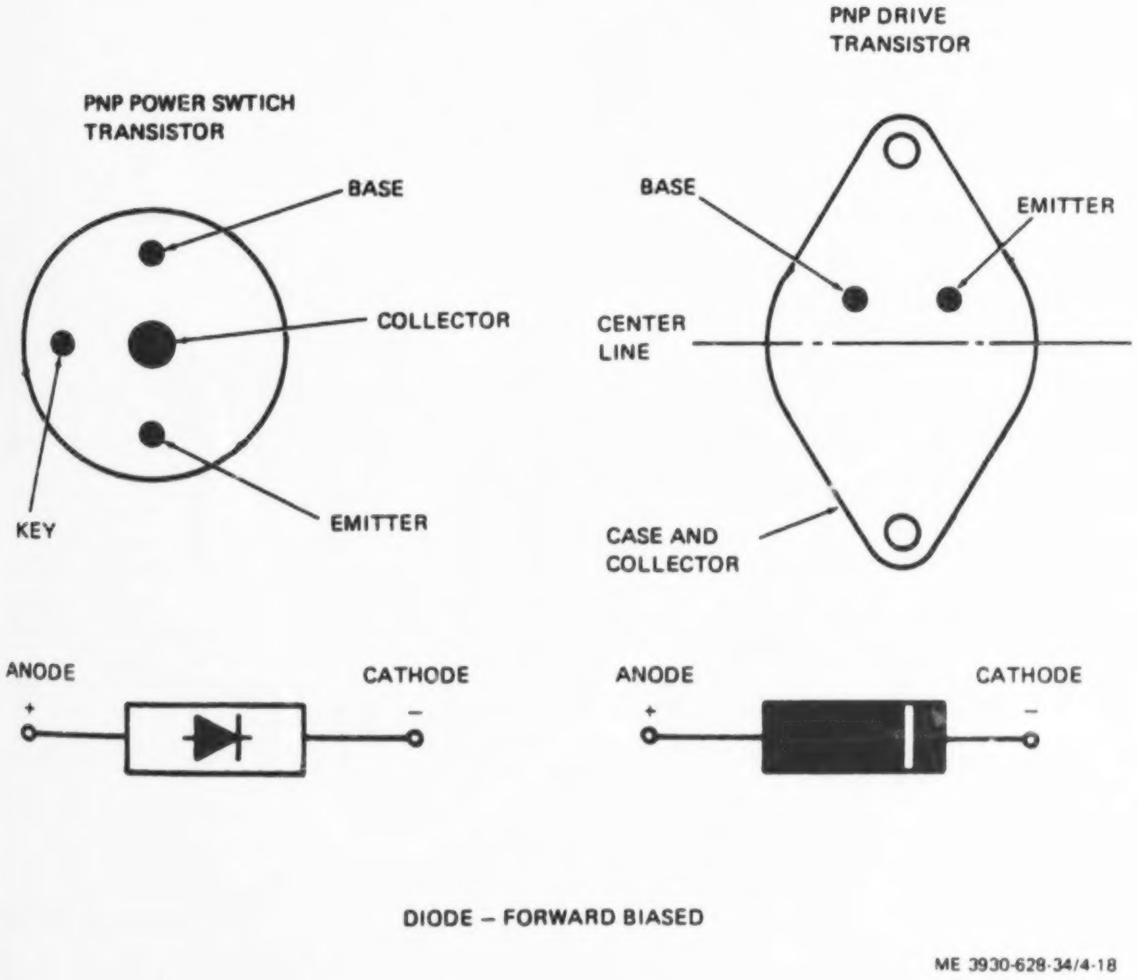
PNP DRIVE TRANSISTOR
PNP POWER SWTICH TRANSISTOR
BASE
COLLECTOR
KEY
EMITTER
BASE
EMITTER
CENTER LINE
CASE AND COLLECTOR
ANODE
+
CATHODE
–
ANODE
+
CATHODE
–
DIODE – FORWARD BIASED
ME 3930-628-34/4-18

Figure 4-18. Transistors and diodes.

d. Disassembly. Refer to figure 4-19 and disassemble the power switch as follows:

(1) Disconnect push-on leads (15 and 45) from top and bottom of the module. Remove screw (22), lock washer (23), and flat washer (24) connecting the emitter leads to the emitter bus bar (21).

(2) Remove the screw (2), lock washer (3) and flat washer (4) connecting each resistor (1) to the collector bus bar (40).

(3) Remove the nylon screw (44), flat washer (32), lock washer (31 and 34), nut (30) and insulator (33) connecting each end of the collector bus bar (40) to the power switch assembly. Slide the collector bus bar out of the power switch assembly.

(4) Remove screw (41), washer (42) and nut (43) to remove the fuse block (37).

(5) Remove the diode bias block (25) by removing screw (28), washer (26) and lock washer (27).

(6) Loosen the nuts (19) at both ends of the insulated frame support bars (13) sufficiently to allow removal of the desired power switch modules (6). Refer to paragraph 4-17 for repair of switch modules.

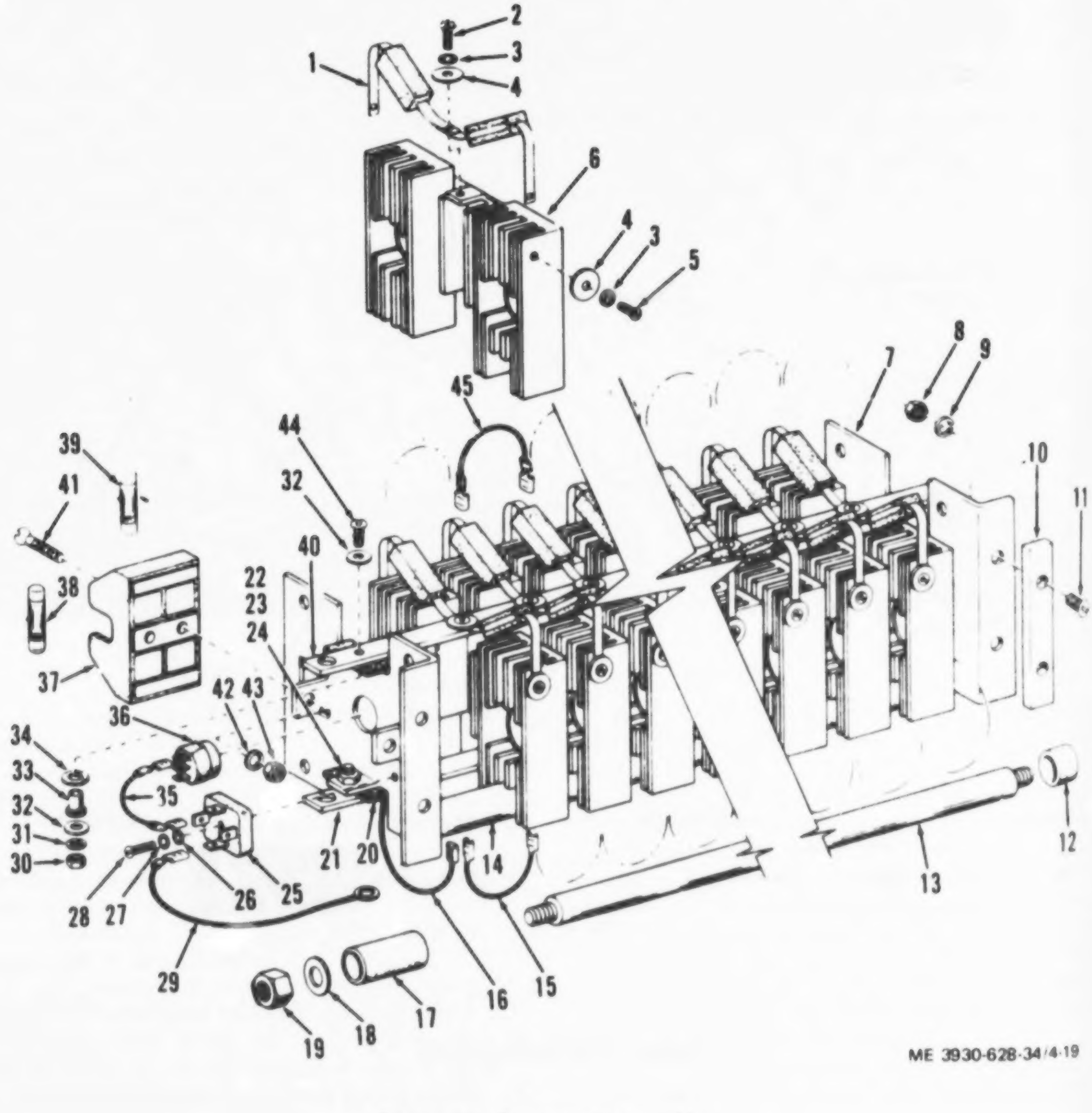

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Figure 4-19. Power switch assembly.

KEY to fig. 4-19:

1. Resistor
2. Screw
3. Lock washer
4. Washer
5. Screw
6. Module
7. End plate
8. Nut
9. Lock washer
10. Insulator
11. Screw
12. Spacer
13. Rod
14. Spacer
15. Lead
16. Lead
17. Spacer
18. Washer
19. Nut
20. Insulator
21. Bus bar
22. Screw
23. Lock washer
24. Washer
25. Diode bias block
26. Washer
27. Lock washer
28. Screw
29. Lead
30. Nut
31. Lock washer
32. Washer
33. Bushing
34. Washer
35. Lead
36. Terminal
37. Fuse block
38. Fuse, 10A
39. Fuse, 5A
40. Bus bar
41. Screw
42. Lock washer
43. Nut
44. Screw
45. Lead

e. Inspection. Visually inspect each of the power switch modules for physical damage to the heat sinks, printed circuit board and components. Replace components as authorized.

f. Assembly. Refer to figure 4-19 and assemble the power switch as follows:

Note. Silicone grease must be applied between the transistors and their heat sinks when replacing any defective transistor.

(1) Assemble the power switch modules on the frame support bars (13) between the end plates (7).

(2) Mount the fuse block (37) on the power switch with screw (41), washer (42) and nut (43).

(3) Mount the diode bias block (25) on the end plate (7) with screw (28) and washers (26 and 27).

(4) Position the collector bus bar (40) under the resistors (1) and on top of the module (6). Secure the bus bar (40) to the end plate (7) with screws (44), lock washers (31 and 34), flat washers (32), insulators (33) and nuts (30).

(5) Secure the resistor (1) in place with screws (2 and 5) and lock washers (3) and flat washers (4).

(6) Connect the jumper leads (15 and 45) and double check wiring for any possible errors.

g. Installation.

(1) Mount each end plate of the power switch assembly on the swing out door and secure with flat head screws, washers, and nuts as shown in figure 4-17.

(2) Attach all electrical leads to their proper terminals. Double check wiring for possible errors.

(3) Close the swing out door and secure in place with screws.

4-19. Power Switch Modules

a. Description. The power switch consists of two drive transistors and two power transistors. Each pair of transistors is connected in parallel to form a single module.

b. Removal. Refer to paragraph 4-18 *d* (6) for removal of the module from the power switch.

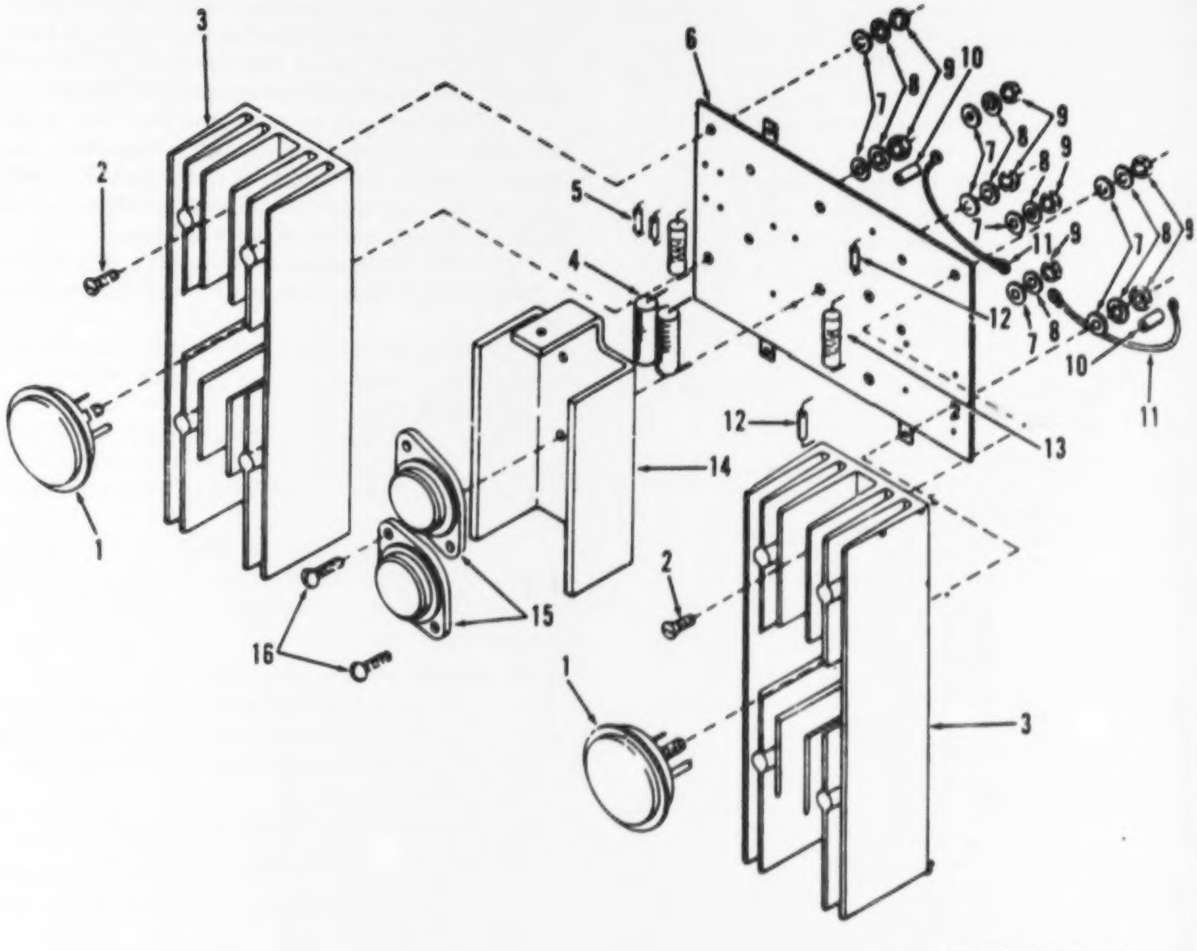
c. Testing. Using a VOM set on the RX1 scale and table 4-1, the condition of the transistors may be determined.

d. Disassembly.

(1) Refer to figure 4-20 and remove nuts (9), lock washers (8), washers (7), and screws (16). Remove the power transistors (1) and the drive transistors (15).

(2) Remove screws (2) and heat sinks (3 and 14).

(3) Using a low wattage soldering iron (30 to 50 watts) remove resistors (4, 5, 12 and 13) as necessary.



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1. Power transistor
2. Screw
3. Heat sink
4. Resistor
5. Resistor
6. Circuit board
7. Washer
8. Lock washer
9. Nut
10. Spacer
11. Lead
12. Resistor
13. Resistor
14. Heat sink
15. Drive transistor
16. Screw

Figure 4-20. Power switch module.

e. Inspection.

(1) Inspect the heat sinks for bent or damaged fins which would affect the amount of heat dissipated by the heat sink.

(2) Inspect the printed circuit board for cracks, warpage, broken electrical path or other damage which could affect the operation of the module.

(3) Replace defective parts as authorized.

f. Assembly. Refer to figure 4-20 and assemble the module as follows:

Note. When reinstalling the transistors on the heat sinks, make sure there is a sufficient amount of silicone grease (Dow Corning 340 silicone heat sink compound) between the transistors and their heat sinks.

(1) Secure the heat sinks (3 and 14) to the circuit board (6) with screws (2), washers (7), lock washers (8) and nuts (9).

(2) Install any resistors that were removed.

(3) Install the transistors (1 and 15) in the respective heat sinks (3 and 14). Secure in place with screws (16), washers (7), lock washers (8) and nuts (9).

g. *Installation.* Refer to paragraph 4-18 *f*(1) for installation of the power switch modules.

4-20. Diode and Capacitor Assembly

a. *Description.* A current is created by the collapsing magnetic field of the motor when the power transistors are turned off. The free wheeling diode provides a path for this current to flow back through the motor in the proper direction. This current flows during the "OFF" time of the 120 time per second pulse, allowing the average motor current to be higher than the average battery current (fig. 4-21).

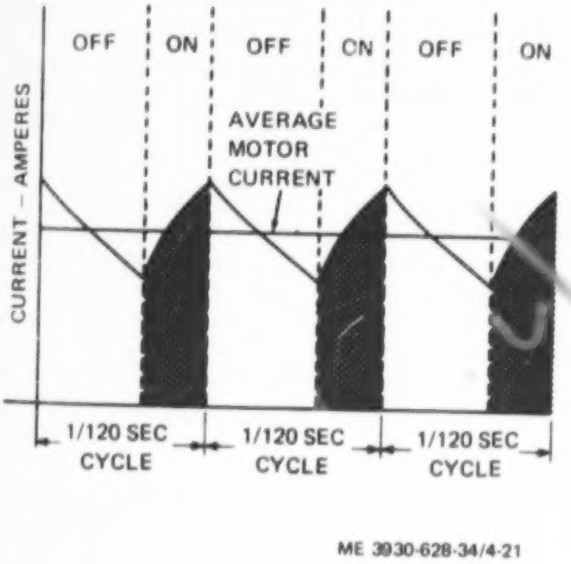


Figure 4-21. Average current.

The armature diode is connected across the armature. It allows rapid direction reversal, prevents the motor from acting as a series generator, and holds the voltage across the armature to a safe level. Operation of this diode is necessary only during rapid reversals. The path of the operation shaping network absorbs the surge of current during the short period of time between the opening of the power switch and the closing of the free-wheeling diode. This current is discharged through the power transistors during their next "on" time.

b. *Removal.*

(1) The capacitor and diode assembly is mounted under the toe plate, within the frame, above the left front wheel.

(2) Remove and tag all electrical leads.

(3) Remove the screw (fig. 4-22), nuts and washers securing the assembly to the frame. Remove capacitor and diode assembly.

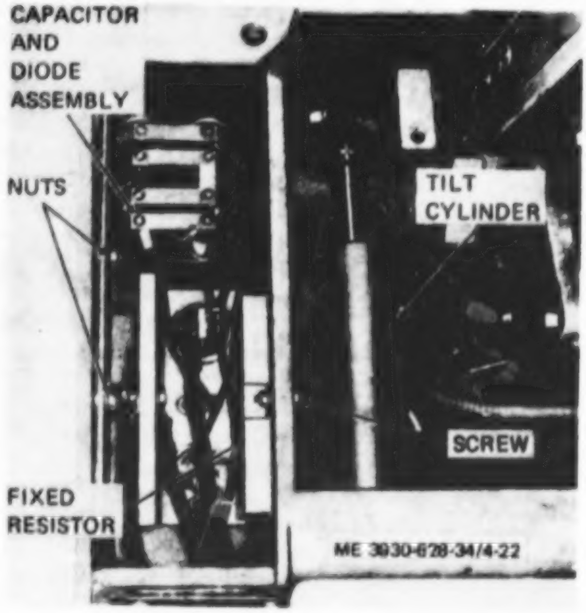


Figure 4-22. Capacitor and diode assembly, installed view.

c. *Disassembly.* Refer to figure 4-23 and disassemble the capacitor and diode assembly as follows:

(1) Remove and tag electrical leads (1 and 2) from capacitors (3 and 4). Loosen adjustable metal strap (5) sufficiently to allow removal.

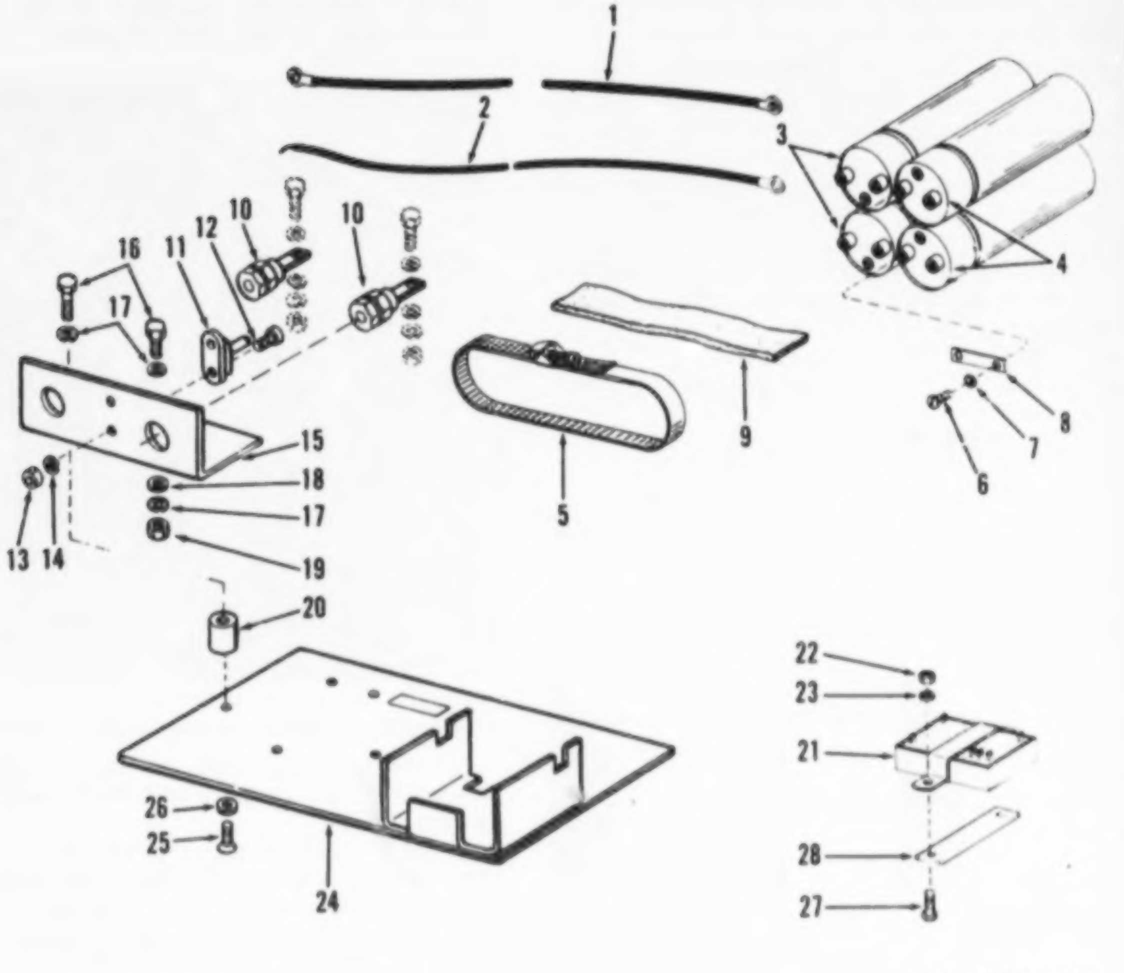
(2) Remove screws (6), lock washers (7) and links (8). Remove weatherstrip (9).

(3) Remove and tag electrical connections to diodes (10 and 11). Remove screw (12), nut (13) and lock washer (14) to remove diode (11) from support (15).

(4) Remove nuts securing diodes (10) to support. Do not remove support (15) unless replacement is necessary.

(5) Disconnect electrical connections to resistor (21). Remove nuts (22), lock washers (23) and screws (27) from mounting strap and lift resistor and insulator (28) the base assembly.

d. *Inspection.* Visually inspect all components for physical damage to terminals, solder joints or any other damage which would impair or prevent proper operation. Check capacitors for cracks or electrolyte leakage. Check electrically for opens or shorts.



ME 3930-628-34/4-23

1. Lead
2. Lead
3. Capacitor
4. Capacitor
5. Strap
6. Screw
7. Lock washer
8. Link
9. Weatherstrip
10. Diode
11. Diode
12. Screw
13. Nut
14. Lock washer
15. Support
16. Screw
17. Lock washer
18. Washer
19. Nut
20. Spacer
21. Retainer
22. Nut
23. Lock washer
24. Base
25. Screw
26. Washer
27. Screw
28. Insulator

Figure 4-23. Capacitor and diode assembly, exploded view.

e. Assembly. Refer to figure 4-23 and assemble the diode and capacitor assembly as follows:

(1) Secure resistor (21) and insulator (28) to the frame with nuts (22), lock washers (23), and screws (27).

(2) Secure the diode (11) to the support (15) with screws (12), nuts (13) and lock washers (14). Secure diodes (10) with hex nuts. Apply a light coat of silicone grease to support (15) in area of diodes to assure complete contact between support surface and diodes for heat sink purposes.

(3) Install links (8) with screws (6) and lock

washers (7). Position the capacitors (3 and 4) in the metal band (5). Place weather strip (9) between the capacitors and the metal band. Tighten the band snugly.

(4) Connect electrical leads (1 and 2) that were removed during disassembly.

f. Installation.

(1) Install the diode and capacitor assembly and resistor in the truck frame.

(2) Secure in place with nuts, washers and screws (fig. 4-22).

(3) Connect all electrical leads and double check wiring for possible errors. Connect leads to resistor.

4-21. Control Board Assembly

a. Description. Refer to figure 4-24.

(1) *Timing and pulse width modulation circuit.*

(a) The basic timing pulses produced by the control board originate in uni junction transistor Q1. These pulses are produced at a steady rate and the rate is assured in part by Zener diode ZD1 which is used for voltage regulation in this part of the circuit.

(b) The conduction of Q1 causes timing capacitor C2 to charge until Q1 cuts off. When Q1 stops conducting, C2 has a discharge path through the frequency adjust resistor R56. As C2 reaches the discharge condition, Q1 conducts again and the cycle is repeated. The setting of R56 determines the rate of discharge (frequency of pulses) of C2. (The resistance value of R56 is determined at the factory.)

(c) The pulses from Q1 uni junction circuit, which are developed across R14, are delivered to transistors Q3 and Q4 which are connected in a flip-flop circuit. The characteristics of the flip-flop circuit are such that while one side is conducting the other one is cut off. Each pulse developed across R14 causes the conducting side of the flip-flop to be cut and the cutoff side to start conducting.

(d) Resistor R7, capacitor C3, and transistor Q2 form a differentiating circuit that converts the output of the flip-flop into sharp pulses that occur (120 times per second) at the rate determined by the setting of frequency adjust resistor R56. When Q3 turns off, a pulse of drive current is applied through the emitter-base junction of Q2 to turn it on briefly. But this is a pulse of drive current only, because as soon as C3 charges, the current must stop. The capacitor discharges back around through the flip-flop when Q3 turns on again and prepares itself for the next cutoff of Q3.

(e) The brief conduction of Q2 during the pulse allows drive current to flow from common (B2+) through the emitter-collector junction of pulse amplifier transistor Q7 to the junction between resistors R23 and R24. The path of current flow is then through R24 to the -15 volts at terminal 6. This current flow turns Q7 on for the brief period of the drive current pulse. When the drive current pulse ends, Q7 turns off and waits for the next pulse.

(f) The fall in voltage at the collector Q7 during its ON time is coupled through diode D14 and resistor R27 to the base of transistor Q8. Diode D14 allows drive current to flow through the base-emitter of Q8 to turn it on for the duration of the pulse. Timing capacitor C15 is connected during that pulse to common (B2+). Current flow from B2+ through Q8, C15 and the base-emitter junction of Q11 to -15 volts at terminal 6 of the control board. This flow charges timing capacitor C15 to approximately 15 volts. The timing capacitor C15, charged to 15 volts by the brief pulses of 120 per second, is given a discharge path through the speed control potentiometer. Current flow is from the positive side of the timing capacitor C15, through resistor R29, along the -15 volt bus, and on terminal 6 to the negative side of the battery. The speed control potentiometer is connected through the contactor panel to common (B2+). Current flow is from common through the variable resistance of the speed control potentiometer, into terminal 5 of the control board and through diode D10 and resistor R37 to the other side of the timing capacitor.

(g) If the timing capacitor C15 was charged only once, and a sufficiently long time was allowed for discharge (longer than a usual cycle), C15 would finally come to equilibrium when it was charged to 15 volts in the opposite polarity. This situation is prevented by the action of transistor Q11. When the timing capacitor has discharged to zero volts, the base-emitter junction of Q11 becomes forward biased, and base current starts to flow, turning Q11 on in saturation. The conduction of Q11 clamps the voltage of the timing capacitor and prevents a buildup of the opposite polarity. The most important effect caused by this circuit is the cutoff of Q11 during the entire cycle after the timing capacitor is charged to its initial polarity. As the speed control potentiometer resistance is reduced, the timing capacitor reaches zero volts at the very end of the cycle interval. Further reduction causes the zero voltage point to be reached sooner, until at zero resistance, the capacitor reaches zero volts at the very beginning of the interval. The translation of the variable position of the speed control potentiometer into a correspondingly varying width of ON pulse of Q11 has now been accomplished. This ON pulse, after being amplified, will be used to provide the control current for the power switch.

(h) The amplifying transistor Q12, at the output of the Q11 collector, turns on and off in direct response to Q11.

(i) Transistor Q11 turns on two times during each cycle. One time is the ON pulse duration directly proportional to the position of the speed control potentiometer. The second turn-on is the brief time during each cycle when the timing capacitor is charged with a brief pulse. This turn-on of Q11 is undesirable and is suppressed or blanked by a blanking pulse, (para 5 *(e)*.)

(j) The variable pulse width output at the collector of amplifier transistor Q12 is coupled through one more amplifier section before the final output. This amplifier performs an inversion so that the final drive to the power switch assembly is in phase with the output Q12. Collector current of Q14 flows through a separate resistor of the resistor assembly. One end of the resistor is connected to terminal 4 of the control board and the other end to the negative side of the battery.

(k) The collector of Q15 is connected at terminal 2 of the control board to one end of a resistor in the resistor assembly; the other end of the resistor is connected to the negative terminal of the battery. Since Q15 handles a considerable amount of current, it is mounted on a heat sink.

(l) Conduction of Q15 allows current to flow from common (B2+), through the emitter-base junction of the cascade connected transistors in all the paralleled modules of the power switch assembly. Current flow is then from the base resistors of the drive transistors into terminal 3 of the control board, through Q15 in its turned on condition, out terminal 2 of the control board, and through the drive resistor in the resistor assembly to the negative side of the battery. The base drive current of Q15 flows through Zener diode ZD3 as part of its normal path.

(2) *Bias generation circuit.*

(a) The bias generation circuit is driven by the Q4 side of the flip-flop circuit. The bias voltage produced is applied at terminal 1 of the power switch assembly, through the diode block to the base of the transistors of the power switch (as stated previously) to keep them turned off in the absence of a control signal. At low operating voltages they could stay off by themselves, but when they are holding off 36 volts, they tend to leak current unless this back bias voltage is present.

(b) This circuit works in such a fashion that transistor Q4 drives transistor Q5, which in turn drives transistor Q6. When Q6 is not conducting, capacitor C7 charges toward 36 volts through diode D2 and through the 33-ohm resistor in the resistor block assembly connected to terminal 7 of the control board. Conduction of Q6 allows current to flow from common (B2+) through Q6. Capacitor C7 discharges through diode D3 and deposits some of its charge in capacitor C8. When this process is repeated several times, the voltage across C8 will build up toward 36 volts. The polarity of this voltage on C8 is such that the negative side is referenced to common (B2+), the positive side of the battery. At the positive terminal of C8, there is a voltage more positive than the battery voltage. A steady voltage more positive than zero volts, but not as high as 36 volts, will be maintained at the positive side of C8. The reason for this is that while the load is continually drawing power, the pulsing circuit is continually building voltage at C8. An equilibrium will be reached when the power in-flow to the circuit equals the power taken out by the load.

(c) The main load path for the bias generating circuit is from the positive terminal of C8 through R54 to terminal 1 of the control board. Terminal 1 of the control board connects to the diode bias block in the power switch assembly. With this permanent load attached, the value of the 33-ohm resistor in the resistor assembly is adjusted so that the positive terminal of C8 retains a charge of about 15 volts. The main load current across R54 is sufficient to produce approximately a 10-volt drop. This voltage clamps the level at terminal 1 of the control board and the power switch assembly to 4.7 volts.

(d) Secondary load paths for the bias generating circuits are through resistors R21, R26, R38, R53, R55 and R61, through D5 and Q16.

(3) *Current sensing circuit.*

(a) The voltage signal provided by the current limit shunt is connected to terminal B1+ of the control board. The signal is divided across a set voltage divider consisting of the current limit adjustment R63, R59, Q13, R42, R39 and TH1 in parallel with gate-cathode junction of SCR1 and C17. Transistor Q13 collector-base junction used as a diode is necessary to prevent interaction between the current sensing and undervoltage sensing circuits. The two circuits meet at a junction between Q13 and R42.

(b) Resistor R42 and capacitor C17 to common (B2+) form a pulse filter with a short time constant. This filter is used to smooth out a thin spike at the leading edge of the power current pulse through the power switch. This spike is above the normal current level and is a result of the free-wheeling diode's inability to immediately recover its blocking condition when the power switch turns on each cycle.

(4) *Undervoltage sensing circuit.*

(a) The undervoltage circuit, connected to the negative side of the battery at terminal 8 of the

control board, samples the voltage across the battery to provide low voltage protection.

(b) One part of the circuit establishes a steady low voltage positive reference voltage. The positive bias voltage at capacitor C8 is filtered by diode D5 and capacitor C12, and is clamped to 8.2 volts by the action of Zener diode ZD2.

(c) Diode D4 and capacitor C13 at terminal 8 of the control board remove surge current from the undervoltage circuit. A voltage divider network, consisting of Zener diode ZD4 and resistor R57 with ZD4 profiding a constant voltage drop, gives a fast acting undervoltage circuit.

(d) The 8.2 reference voltage and the attenuated battery voltage are added at the junction of R58, R49, and D12.

(e) Under normal battery conditions, the add junction is negative with respect to B2+. When the battery has a low specific gravity and is highly loaded, the battery voltage will drop drastically to make the voltage at the add point go positive with respect to B2+ and thus fire SCR1.

(f) Silicon controlled rectifier SCR1 and its associated circuitry, used in the current sensing operation, is shared by the undervoltage circuit and works the same way for this circuit. The SCR1 is held OFF and the power switch assembly is allowed to operate as long as the potential at the junction of R58 and R49 is negative. A positive potential causes D12 to conduct and places a positive signal on the gate of SCR1. This positive gate causes SCR1 to conduct and turn off the power switch.

(5) *Current limit circuit.*

(a) If the signal applied to the gate of SCR1 is a positive voltage of approximately 0.5 volt with respect to its own cathode, SCR1 turns on and stays on until the end of that particular cycle. Current flow is from the positive terminal of the bias generation circuit capacitor C8, through R38, SCR1, and to current limit common C2+. When SCR1 turns on, approximately 15 volts are developed across R38; this voltage turns Q16 on through the resistor network of R60 and R61. When Q16 is on, it connects the base of Q12 to the positive bias voltage through R62; thus Q12 is biased off even though an on signal is present. The reverse bias voltage overcomes the drive signal at the base of Q12.

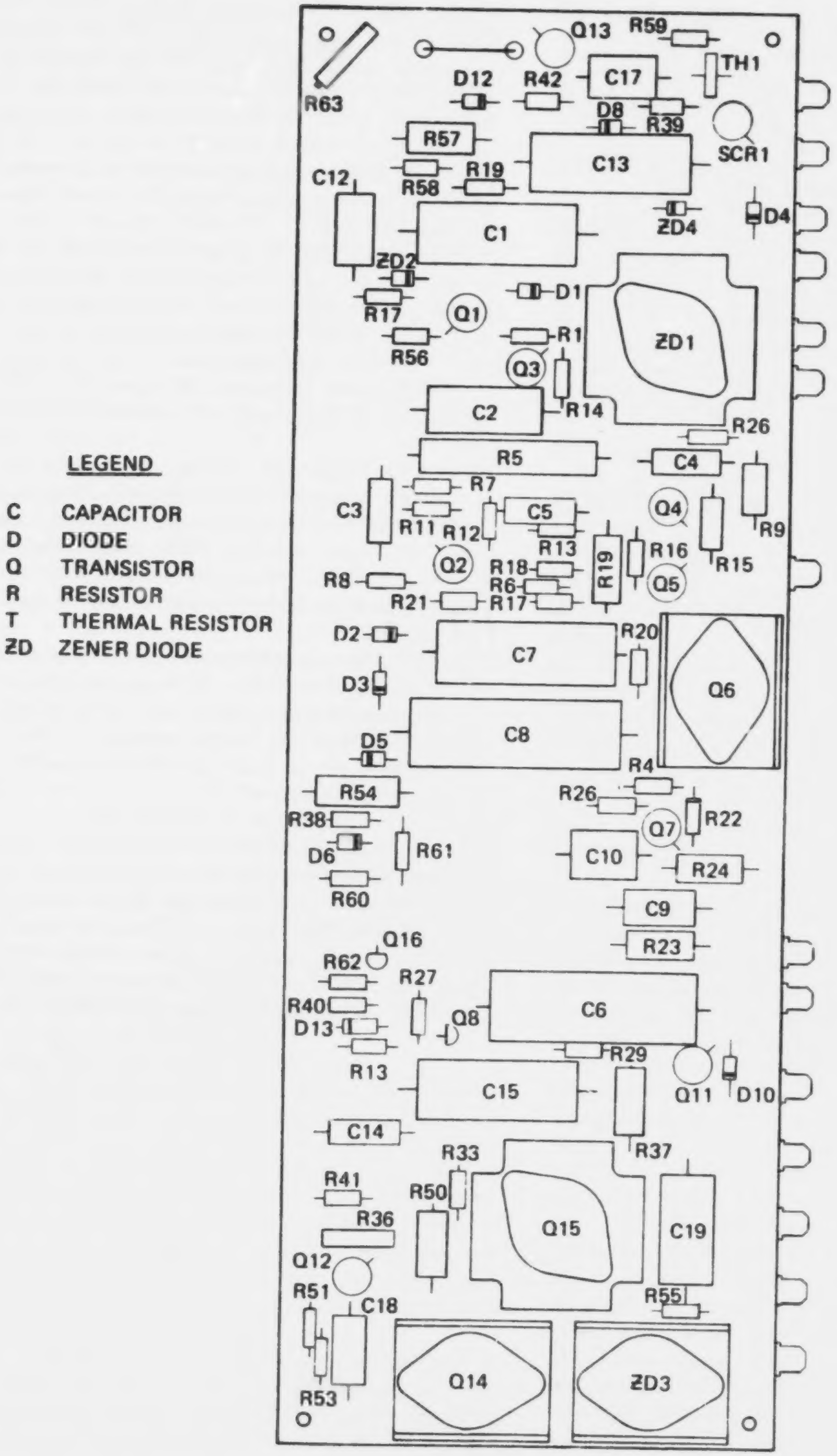
(b) Once SCR1 is turned on it stays on even in the absence of a firing voltage until its anode current is brought to zero long enough for it to recover its forward blocking condition.

(c) The resetting of SCR1 after every cycle is accomplished by diode D6 connected between the anode of SCR1 and the collector of transistor Q7.

(d) When Q7 turns on briefly at the beginning of each cycle as described earlier, the cathode of D6 is clamped to a point more negative than common (B2+). This causes the anode current of SCR1 to be diverted and flow through D6 to this more negative point which allows SCR1 to turn off.

(e) The blanking pulse is derived from the SCR reset pulse. When Q7 turns on, the voltage developed across R38 again turns Q16 on which in turn biases Q12 off. This happens at the same time Q8 and Q11 are on to charge timing capacitor C15; so if Q12 is biased off when Q11 is on to charge C15, blanking has been performed.

(f) While SCR1 is being reset, it is important to remove any pulses to its gate to prevent its firing on some noise pulse. This is accomplished by diode D8. The cathode of D8 is connected to the anode of SCR1 and its anode is connected to the gate of SCR1. Diode D8 clamps any incoming gate signal to a negative voltage while SCR1 is being reset.



Q13
R59
R63
D12
R42
C17
TH1
D8
R39
R57
C13
SCR1
C12
R58
R19
C1
ZD4
D4
ZD2
D1
R17
Q1
R1
ZD1
R56
Q3
R14
C2
R26
R5
C4
C3
R7
R11
R12
C5
Q4
R9
R13
R19
R16
R15
R8
Q2
R18
R6
R21
R17
Q5
D2
C7
R20
Q6
D3
C8
D5
R4
R54
R26
R22
R38
Q7
D6
R61
C10
R24
R60
C9
R23
Q16
R62
R27
C6
R40
Q8
D13
R29
R13
C15
Q11
D10
C14
R33
R37
R41
R50
Q15
C19
R36
Q12
R51
R55
C18
Q14
ZD3
R53

LEGEND

C	CAPACITOR
D	DIODE
Q	TRANSISTOR
R	RESISTOR
T	THERMAL RESISTOR
ZD	ZENER DIODE

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Figure 4-24. Control board assembly.

b. Removal.

(1) Raise front of truck and block frame to leave drive wheels clear of floor.

(2) Remove floor and toe plates.

(3) Remove four screws and remove cover from control board compartment.

(4) Refer to figure 4-25 and remove three screws securing control board assembly to truck frame.

(5) Lift control board assembly out of truck frame by tilting end of control board which is toward front of truck higher than the other end. Lift board up and out of well and rest board on truck frame.

Note. After testing (*c* through *f* below) tag and disconnect all electrical leads and remove control board assembly.

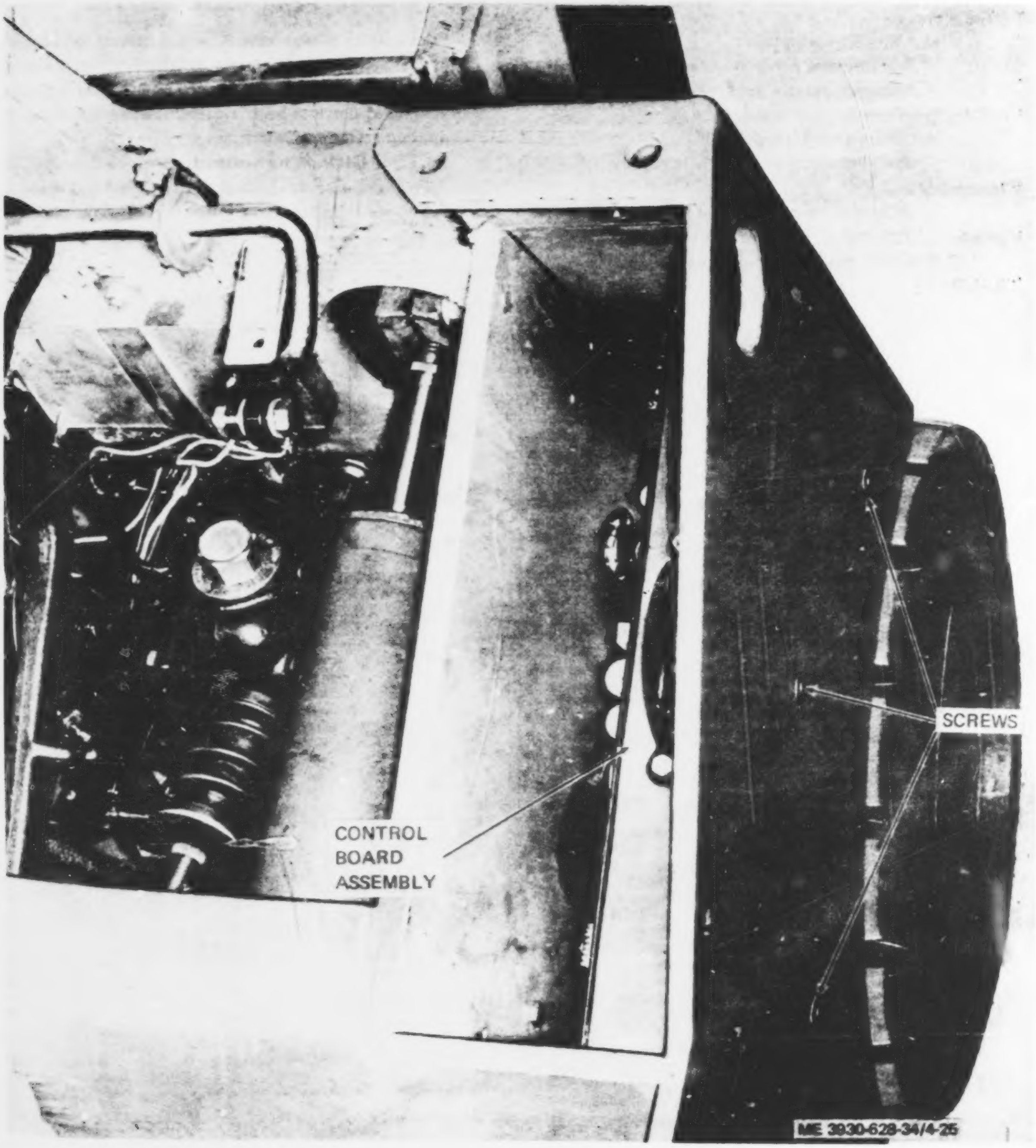

Figure 4-25. Control board assembly removal.

c. Testing. These tests must be conducted with control board assembly connected to the truck circuits.

(1) In order to properly test and rebuild a control board, an oscilloscope must be used. The recommended minimum rquirements for the oscilloscope are as follows:

(a) Horizontal sweep.

1. Calibrated sweep circuit.

2. Sweep range from 1 sec / cm to 0.5 msec / cm.

(b) Vertical amplifier.

1. Calibrated vertical amplifier.

2. Input range from 0.2 V / cm to 10 V / cm preferred.

(c) Frequency response.

1. Frequency response from dc to 1 mh (megahertz / sec).

2. Avoid "wide band type" scope. It may produce distortion of low-frequency waveforms.

(2) A 50 millivolt, 500 amp shunt is also required.

(a) Equipped with battery type connectors to be connected between battery and controls.

(b) Two, approximately 12 inch long, leads equipped with quick-disconnect clips for use as jumper cables.

(3) Test stand.

(a) A permanent test stand is not necessary to perform the following tests. However, if one is available it should be used to assist in testing and repairing the control boards as outlined in table 4-2.

(b) If a test stand is not used, lay control board assembly face up on a table or on the truck frame (while still connected to the truck harness). Insure that control board components do not come in contact with truck frame.

(c) Before the protective circuit board can be properly checked, the control board must be checked and must be good.

REFERENCE DESIGNATIONS

C	Capacitor
D	Diode
Q	Transistor
R	Resistor
T	Thermal Resistor
Z	Zener Diode

ELECTRICAL SYMBOLS

⊣⊢	Capacitor
→|	Diode
µf	Microfarad
Ω	Ohms
▭	Resistor
⊘	Adjustable Resistor
k	1000 Ohms
⊗	Transistor

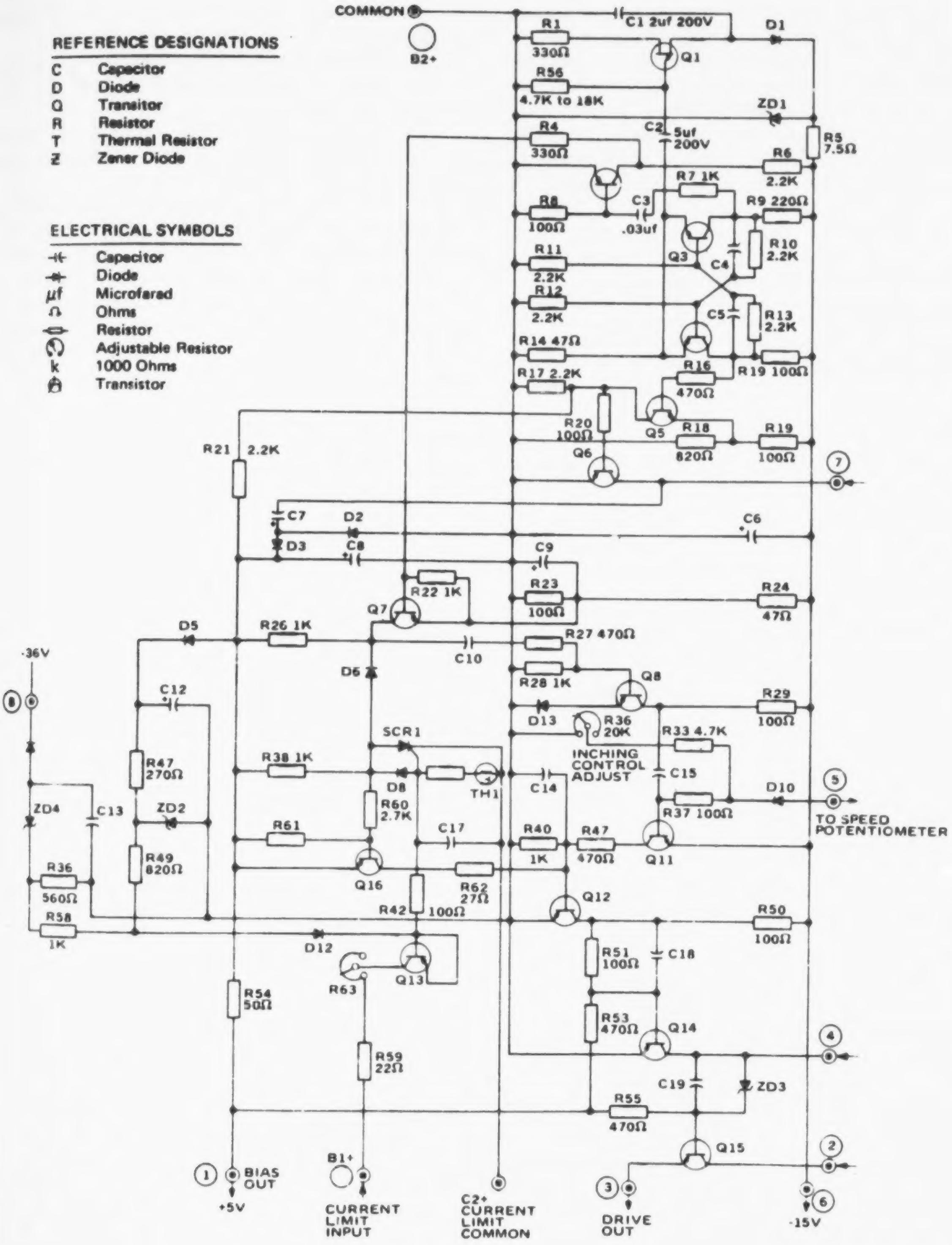
COMMON
B2+
C1 2uf 200V
R1 330Ω
Q1
D1
R56 4.7K to 18K
ZD1
R4 330Ω
C2 5uf 200V
R5 7.5Ω
R6 2.2K
R7 1K
C3 .03uf
R8 100Ω
R9 220Ω
Q3
R10 2.2K
R11 2.2K
C4
R12 2.2K
C5
R13 2.2K
R14 47Ω
R16 470Ω
R19 100Ω
R17 2.2K
R20 100Ω
Q5
R18 820Ω
R19 100Ω
Q6
R21 2.2K
7
C7
D2
C6
D3
C8
C9
R22 1K
R23 100Ω
R24 47Ω
Q7
D5
R26 1K
R27 470Ω
C10
-36V
8
D6
R28 1K
Q8
C12
D13
R36 20K
R29 100Ω
SCR1
INCHING CONTROL ADJUST
R33 4.7K
R47 270Ω
R38 1K
D8
TH1
C14
C15
D10
5
TO SPEED POTENTIOMETER
ZD4
C13
ZD2
R60 2.7K
R61
C17
R40 1K
R47 470Ω
R37 100Ω
Q11
R36 560Ω
R49 820Ω
Q16
R62 27Ω
R42 100Ω
Q12
R58 1K
R50 100Ω
D12
R51 100Ω
C18
R63
Q13
R54 50Ω
R53 470Ω
Q14
4
R59 22Ω
C19
ZD3
R55 470Ω
Q15
2
1 BIAS OUT
+5V
B1+
CURRENT LIMIT INPUT
C2+ CURRENT LIMIT COMMON
3
DRIVE OUT
6
-15V

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Figure 4-26. Control board assembly schematic wiring diagram.

(4) *Circuit tests.* Test the circuit board as directed in Table 4-2. This table will give the scope settings, the test connections to be made and the readings that are to be obtained. This table will also give the cause of the defect if one should exist. Replace any defective parts as authorized. The wave forms on figures 4-28, 4-30, 4-32, 4-34 and 4-38 and the test connections shown on figures 4-27, 4-29, 4-31, 4-33 and 4-35 are given to aid the performance of the tests.

Note. The following tests will be performed with the control board assembly connected to the truck harness. An operator must occupy the seat and move the controls as directed to perform the tests. The emergency stop switch and seat switch must be closed to make the circuits operative. Figure 4-26 is a schematic diagram of the control board circuits.

(a) Unless otherwise indicated, the tests are to be performed with the key switch on.

(b) Touch the oscilloscope probes at the points listed under "Connections" to get the readings specified.

(c) In test numbers 10a, 10b, 11, 12, 13 and 14 the following conditions under connection are applicable:

1. The note (speed at min. value) is obtained by placing the forward and reverse control lever in forward or reverse and depressing the accelerator slightly to actuate the foot switch.

2. The note (speed at max. value) is obtained by placing the forward and reverse control lever in forward or reverse and depressing the accelerator completely to the floor.

Table 4-2. *Circuit Board Test Locations and Results*

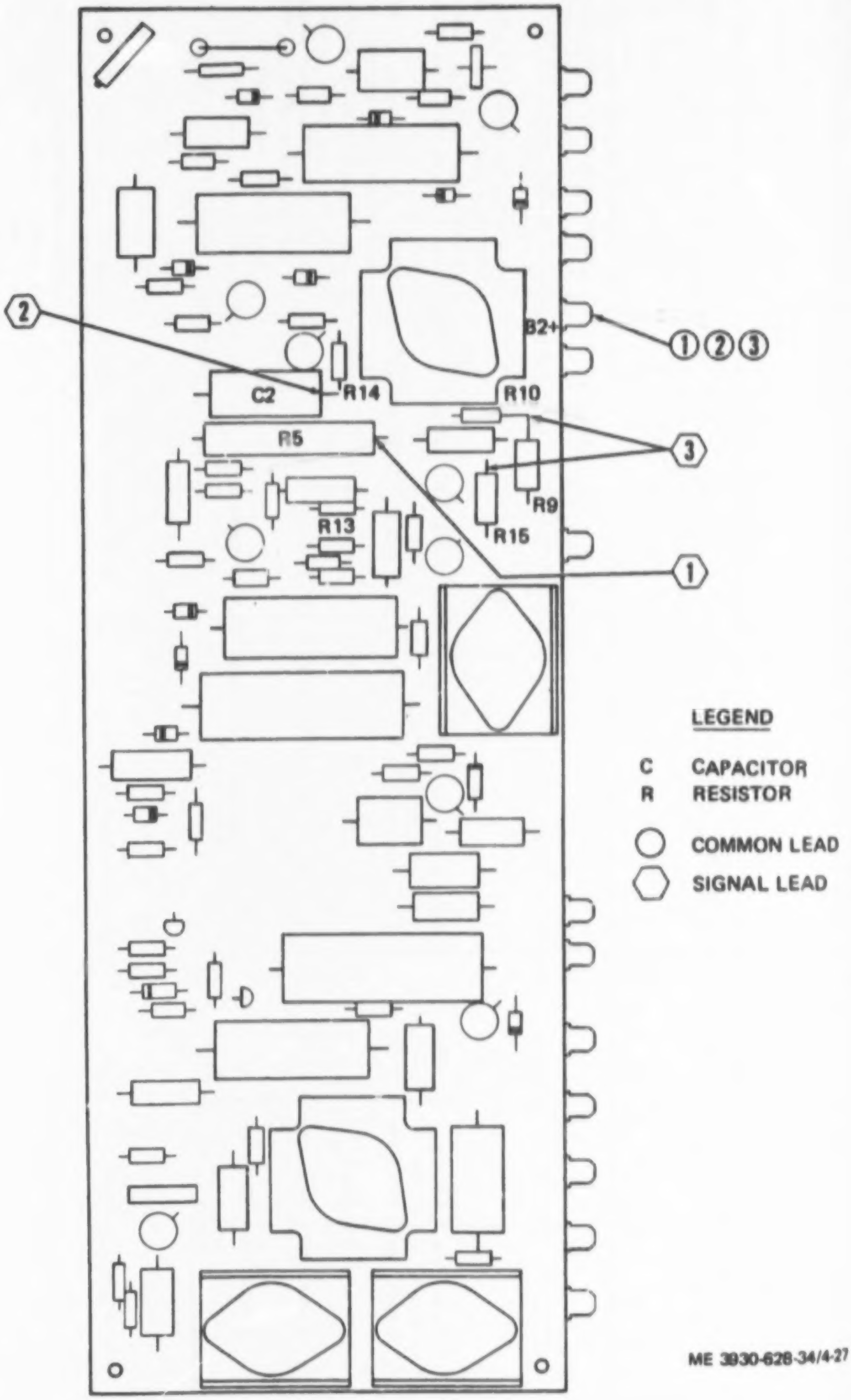
Test No.	Scope Settings		Trigger	Connections	Readings	Wave shape (fig.)	Possible cause
	Horizontal Sweep	Vertical Amp					
1	1 msec / cm	5 V / cm	—Ve	B2+ to junction of R5 and ZD1 (fig. 4-29)	—9.8 V steady dc voltage	4-28*a*	Wrong or defective resistor or connections from term. No. 6 control board and resistor assy. and connections to key switch or negative battery term. Also, ZD1 (SZ1651 Zener diode) shorted, short circuit on control board, shorted C6 (1000 mfd, 25V capacitor).
2	1 msec / cm	2 V / cm	—Ve	B2+ to junction of C2 and R14 (fig. 4-29)	—2.8 V Spike to —5.5 V Pulses 4.2 Ms apart	4-28*b*	Defective resistor R56 (frequency control), defective Q1 (2N1671A), open or shorted capacitor C2 (0.5 mfd), D1 open, shorted or installed backwards or if instability is present, D1 (1N4002 diode) may be shorted.
3	1 msec / cm	5 V / cm	—Ve	B2+ to junction R9 and R10 B2+ to junction R13 and R15 (fig. 4-29)	—8 V	4-28*c*	To set frequency, change value of R56 (may have values of 4.7K to 18K ohms) until pulses are 8.3 msec apart. Defective Q3 or Q4, or both transistors faulty (shorted, open, leaky, low gain). Wrong values of R9, 10, 11, 12, 13, 14, 15 and R7 & R16. Also possible loading through R7 and R16; disconnect these resistors and retest.
4	1 msec / cm	5 V / cm	+Ve	B2+ to terminal No. 7 (fig. 4-31)	—9.9 V	4-30*a*	Transistors Q5 or Q6 shorted, incorrect values of resistors: R16, 17, 18, 19, 20, and 21. Open condition in term. No. 7 circuit.
5	1 msec / cm	5 V / cm	+Ve	B2+ to junction of R54 and R61 (fig. 4-31)	+16.3	4-30*b*	Capacitors C8 or C7 shorted or installed backwards, diodes D2 or D3 open, shorted, or installed backwards. If the voltage measured is excessively high, the resistor in resistor block connected to term. No. 7 may be of wrong value, or the power switch diode bias block may be connected backwards or may be open.

Table 4-2. Circuit Board Test Locations and Results—Continued

Test No.	Scope Settings		Trigger	Connections	Readings	Wave shape (fig.)	Possible cause
	Horizontal Sweep	Vertical Amp					
6	1 msec / cm	2 V / cm	+Ve	B2+ to terminal No. 1 (fig. 4-31)	4.9 V Steady DC voltage	4-30*c*	Possible heavy load or short circuit; remove loads (disconnect lead on term. No. 1 and unsolder R55) separately until voltage rises to +15 volts. If voltage does not rise, determine location of fault. If voltage does not rise, R54 may be open.
7	1 msec / cm	5 V / cm	+Ve	B2+ to junction of R4 and R6 (fig. 4-31)	—11.7 V, Narrow pulse from steady —11.7V to about 0 V	4-30*d*	Transistor Q2 shorted or open, capacitor C3 open.
8	1 msec / cm	5 V / cm	+Ve	B2+ to junction of R26 and C10 (fig. 4-33)	+15.9 V, Narrow pulse from almost +15.9 V to —10 V	4-32*a*	Defective transistor Q7, incorrect values of R22, 23, 24 resistors, faulty capacitor C9.
9	1 msec / cm	5 V / cm	+Ve	B2+ to junction of C15 and R29 (fig. 4-33)	—14.1 V, Narrow pulse from steady —14.1 to 0 V	4-32*b*	Faulty R27 resistor or capacitor C10 Defective transistor Q8 (open or shorted).
10a	1 msec / cm	10 V / cm	—Ve	B2+ to junction of C15 and R37 (speed at min value) (fig. 4-33)	—20.5 V	4-32*c*	Diode D10 open or installed backwards, speed pot faulty, inching trimpot R36 faulty.
10b	1 msec / cm	10 V / cm	+Ve	B2+ to junction of C15 and R37 (speed at max value) (fig. 4-33)	—12.5 V almost steady	4-32*d*	
11	1 msec / cm	2 V / cm	+Ve (speed max) —Ve (speed min)	B2+ to junction of C18 and R50 (fig. 4-33)	—0.1 V (speed max) —7.5 V (speed min)	4-32*e*	Faulty transistors Q11, Q12, wrong component values. Faulty or maladjusted inching trimpot R36.
12	1 msec / cm	5 V / cm	—Ve	B2+ to terminal No. 4 (fig. 4-35)	—0.1 V (speed min) —11.7 V (speed max) Square wave from steady —11.7 V to —0.1V (fig. 4-34)	4-34*a*	Faulty resistor connected to term. No. 4 in resistor assembly. Faulty transistor Q14, resistor R53, or open or intermittent bias connection to control board term. No. 1. If square wave is not sharp and square, capacitor C18 may be faulty.
13	1 msec / cm	10 V / cm	—Ve (speed max) +Ve (speed min)	B2+ to terminal No. 2 (fig. 4-35)	—36.7 V (Speed min) —6.8V (speed max) Square wave from —6.8 V to about —36V	4-34*b*	Q15 transistor or ZD3 faulty, R55 open. Faulty resistor in resistor assy. that is connected to term. No. 2. If wave is not sharp and square, capacitor C19 may be faulty.

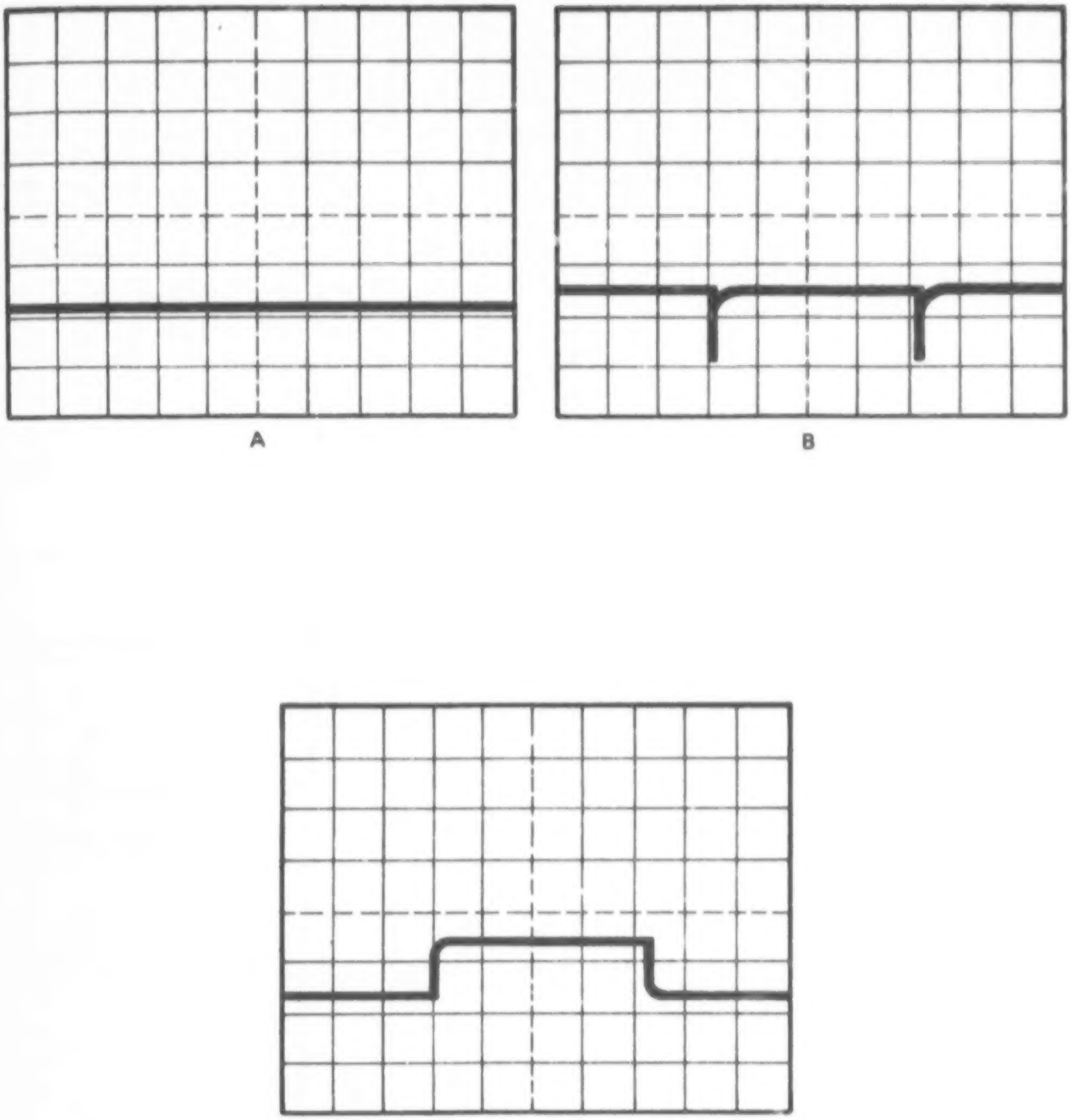
Table 4-2. Circuit Board Test Locations and Results—Continued

Test No.	Scope Settings		Trigger	Connections	Readings	Wave shape (fig.)	Possible cause
	Horizontal Sweep	Vertical Amp					
14	1 msec / cm	2 V / cm	—Ve	B2+ to terminal No. 3 (fig. 4-35)	+3.2 V (speed min) —4.8 V (speed max) Square wave from steady —4.8 V to +3.2 V	4-34*c*	Open circuit to power switch term. No. 3. Q15 transistor or ZD3 faulty.
15	2 msec / cm	2 V / cm	0	B2+ to terminal No. 3 (fig. 4-35)	3V to —6V	4-34*d*	*a*. Current limit too low - wrong current limit shunt, wrong value of resistor R42, capacitor C17 faulty, current limit resistor R5 faulty or incorrect value. *b*. Current limit at all times - SCR1 shorted, capacitor C17 open, diode D8 shorted, Q16 faulty.
16	1 msec / cm	5 V / cm	+Ve	B2+ to junction of R47 and ZD2 (fig. 4-37)	+8.2V Steady DC Voltage	4-36*a*	Diode D5 open, R47, R49, C12 or ZD2 faulty.
17	1 msec / cm	10 V / cm	+Ve	B2+ to terminal No. 8 (fig. 4-37)	—36.5V Steady DC Voltage	4-36*b*	If this voltage is improper, the cause must be something external to the board, i.e. a fuse, fast-on terminal, wire, etc.
18a	2 msec / cm	10 V / cm	+Ve	B2+ to junction of D8 and R38 (fig. 4-37)	+15.8 V to —5 V	4-36*c*	*a*. SCR1, D8, TH1, or C17 faulty. *b*. Current limit at all times - SCR1 or Q16 may be shorted.
18b	2 msec / cm	10 V / cm	0	B2+ to junction of D8 and R38 (fig. 4-37)	0V to irregular	4-36*d*	


②
B2+
①②③
C2
R14
R10
R5
③
R9
R13
R15
①
LEGEND
C CAPACITOR
R RESISTOR
○ COMMON LEAD
⬡ SIGNAL LEAD

ME 3930-628-34/4-27

Figure 4-27. Control board test locations (tests 1, 2 and 3).



A

B

C

ME 3930-628-34/4-28

Figure 4-28. Oscilloscope waveshapes (tests 1, 2 and 3).

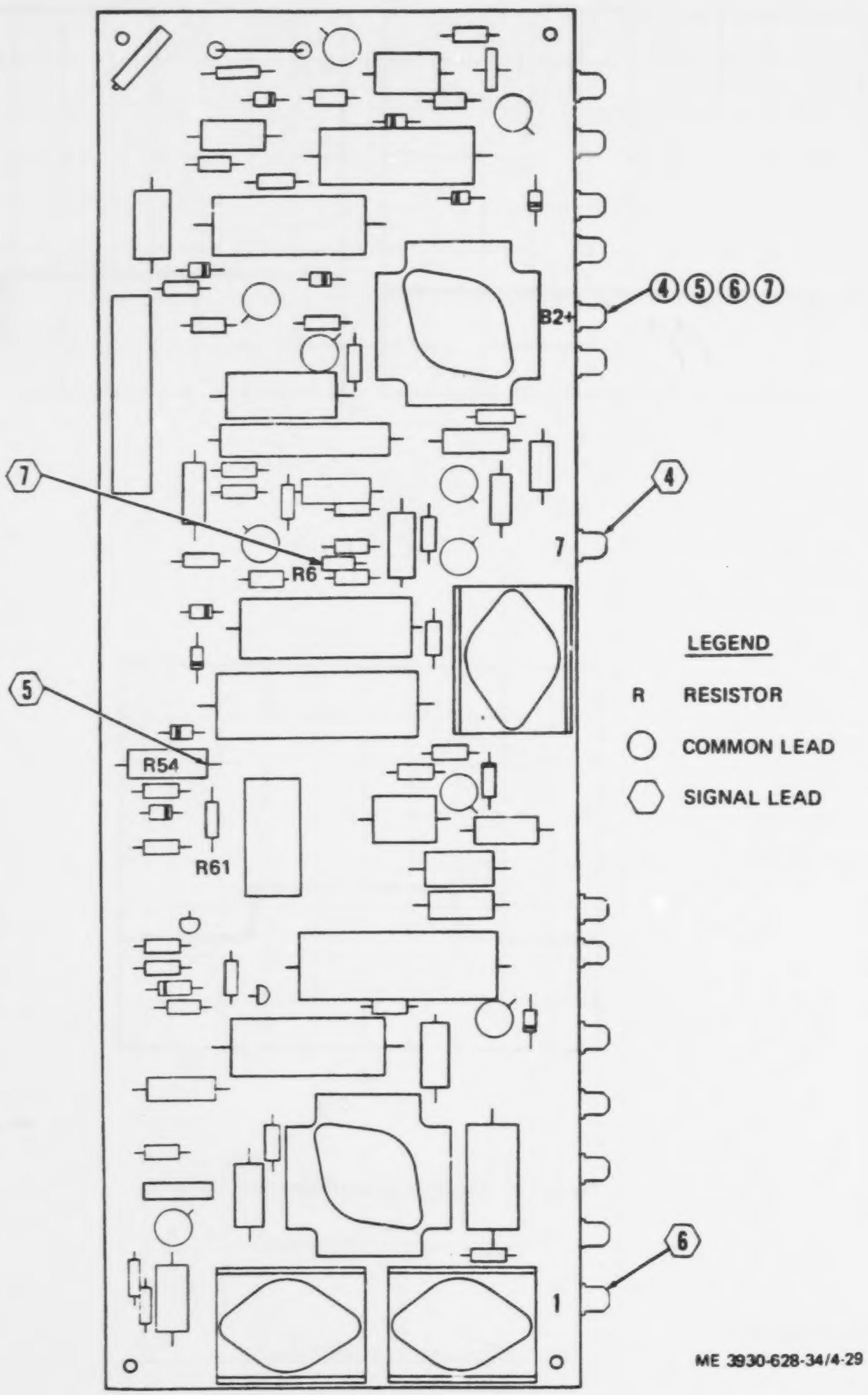
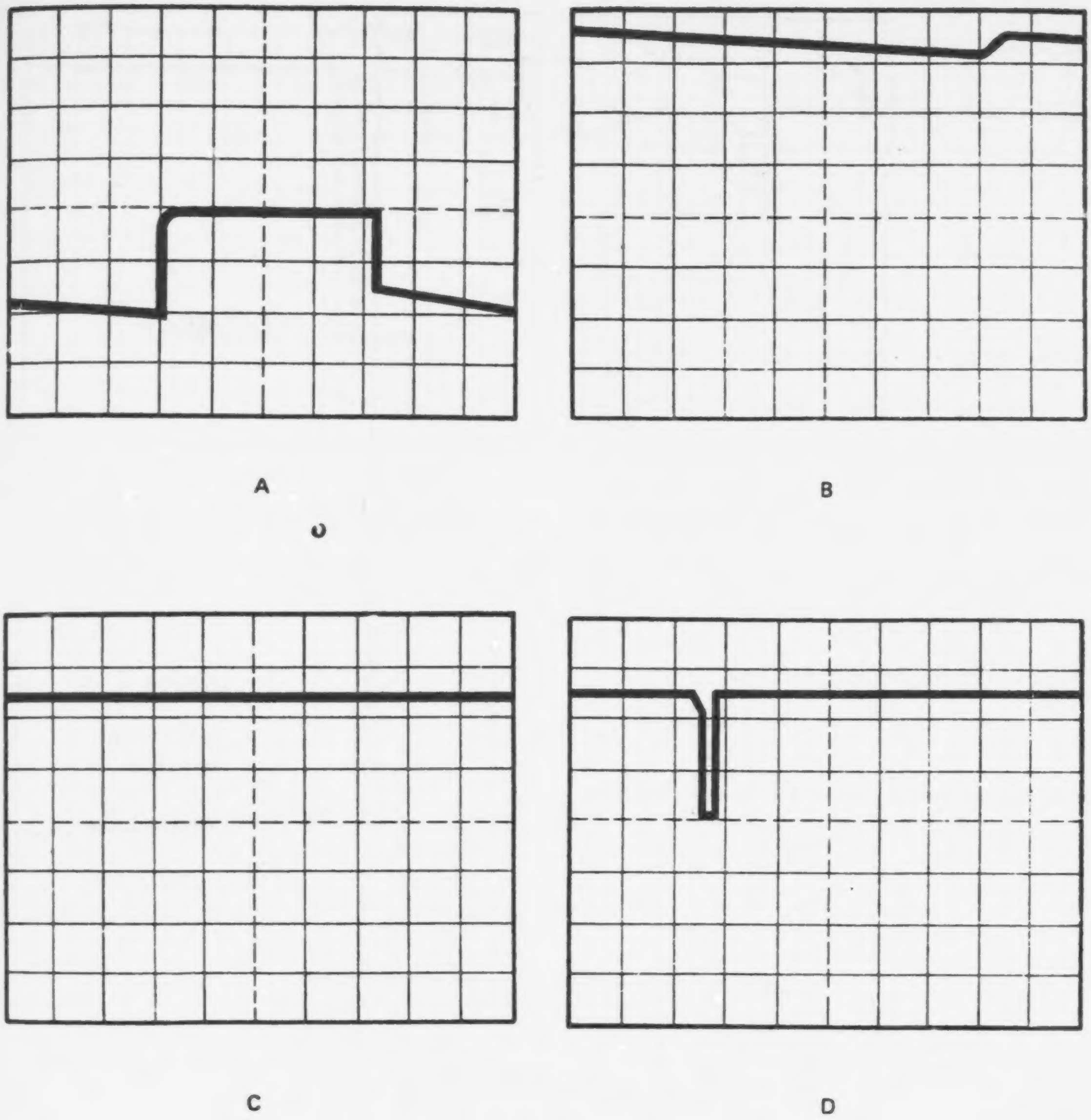

④⑤⑥⑦
B2+
7
R6
4
7
LEGEND
R RESISTOR
○ COMMON LEAD
⬡ SIGNAL LEAD
5
R54
R61
6
1
ME 3930-628-34/4-29

Figure 4-29. Control board test locations (tests 4 thru 7).



ME 3930-628-34/4-30

Figure 4-30. Oscilloscope waveshapes (tests 4 thru 7).

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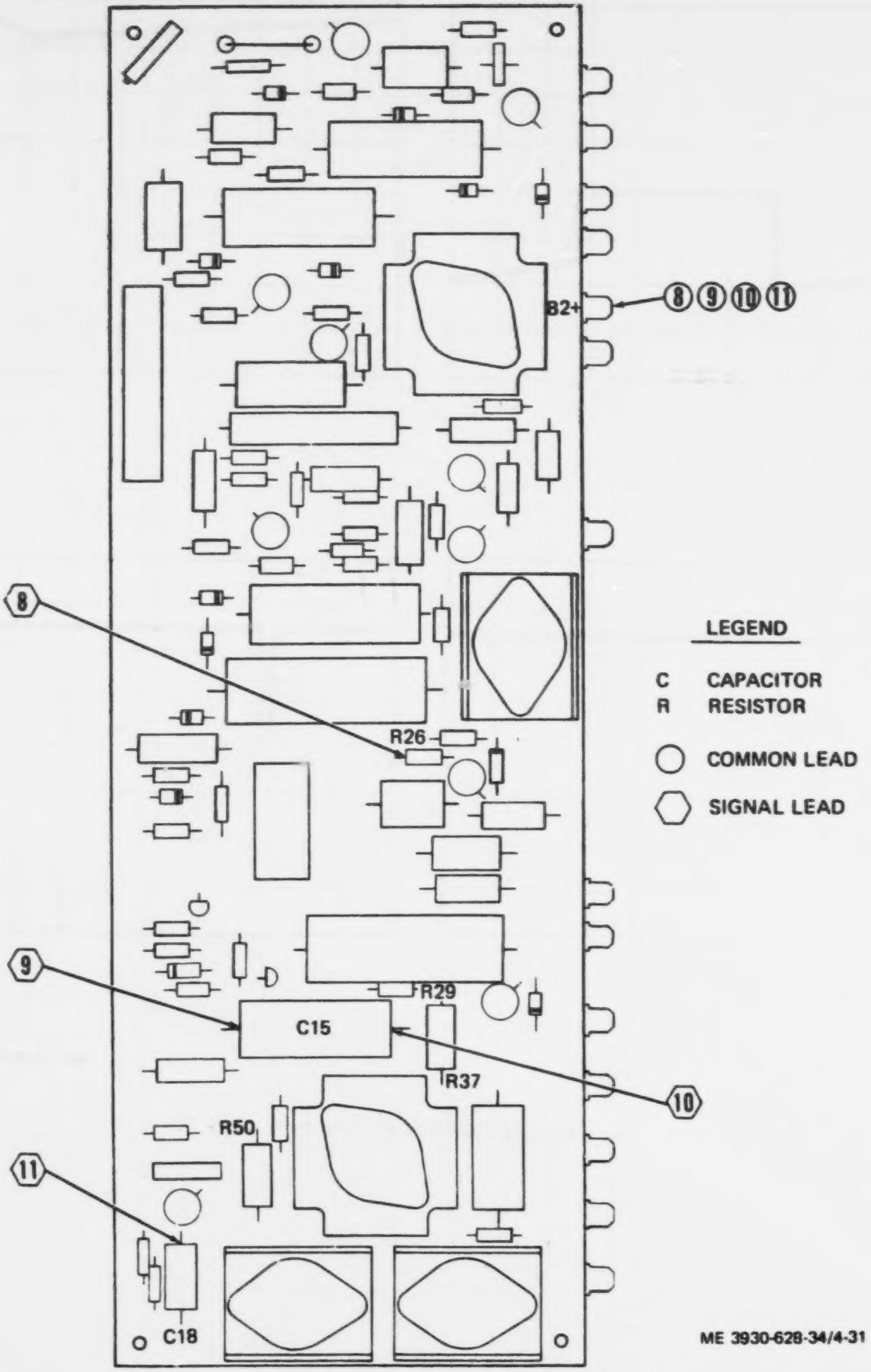
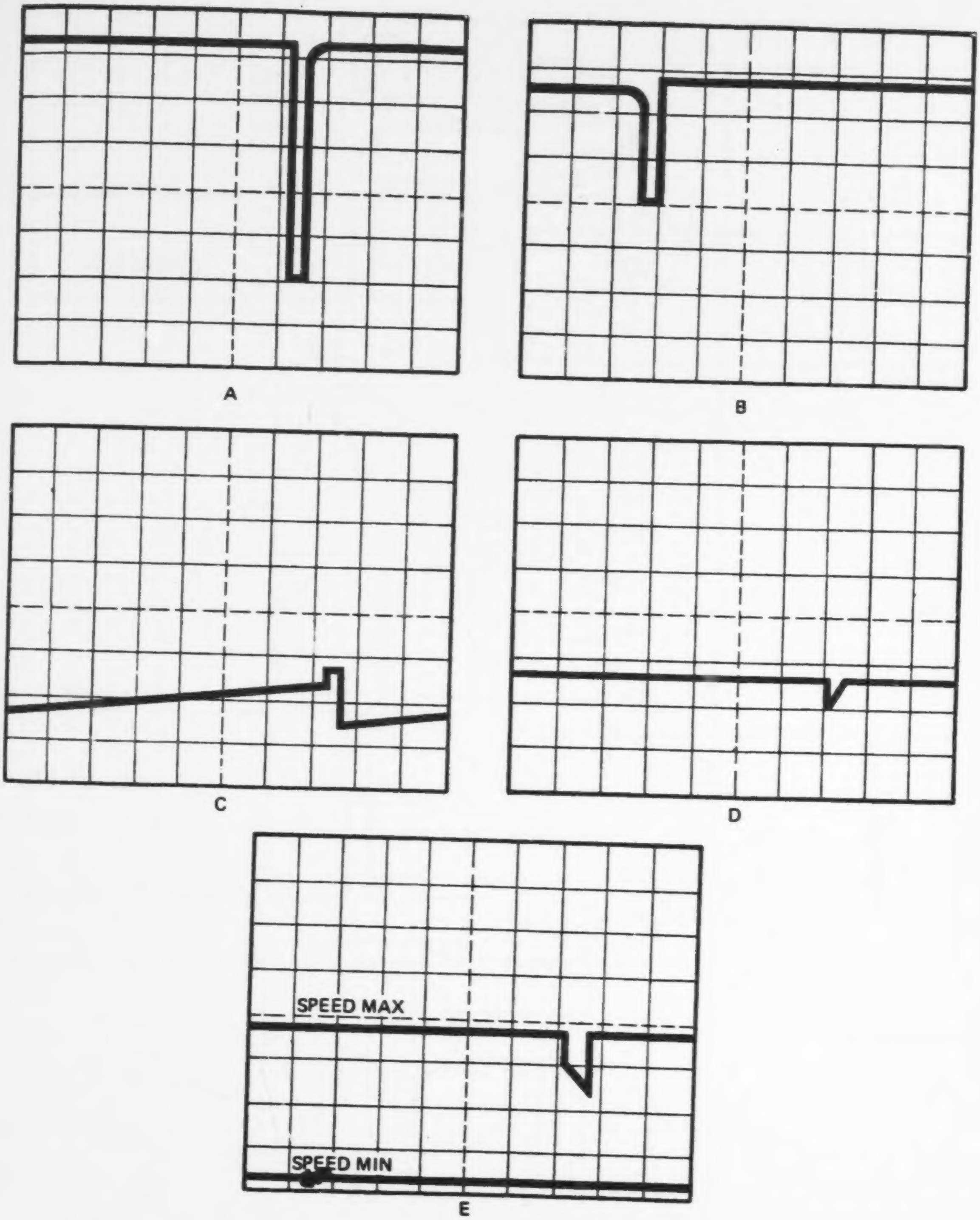

B2+
⑧⑨⑩⑪
8
R26
9
C15
R29
R37
10
R50
11
C18
LEGEND
C CAPACITOR
R RESISTOR
○ COMMON LEAD
⬡ SIGNAL LEAD
ME 3930-628-34/4-31

Figure 4-31. Control board test locations (tests 8 thru 11).



ME 3930-628-34/4-32

Figure 4-32. Oscilloscope waveshapes (tests 8 thru 11).

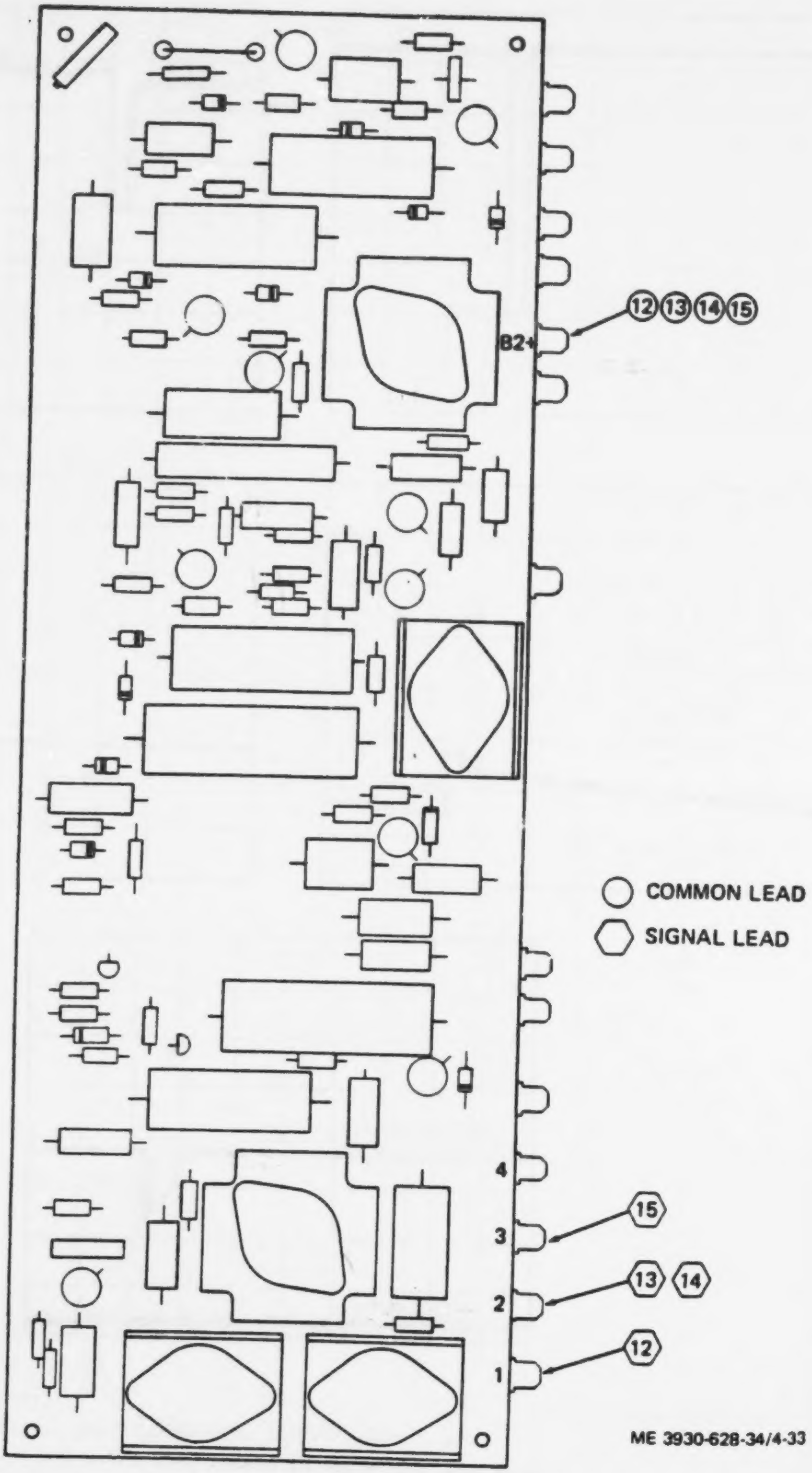

⑫⑬⑭⑮
B2+
15
13 14
12
4
3
2
1
COMMON LEAD
SIGNAL LEAD
ME 3930-628-34/4-33

Figure 4-33. Control board test locations (tests 12 thru 15).

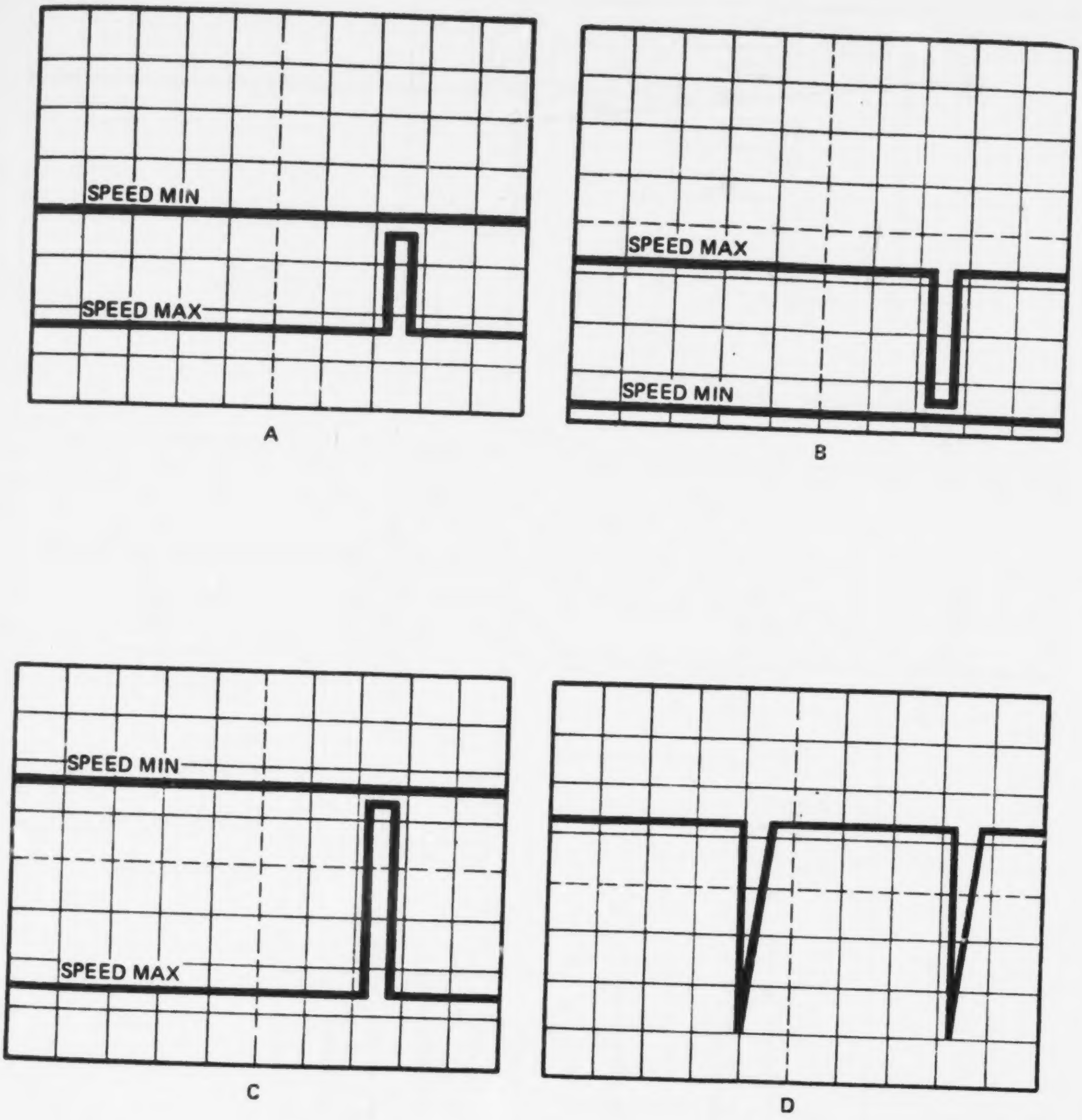
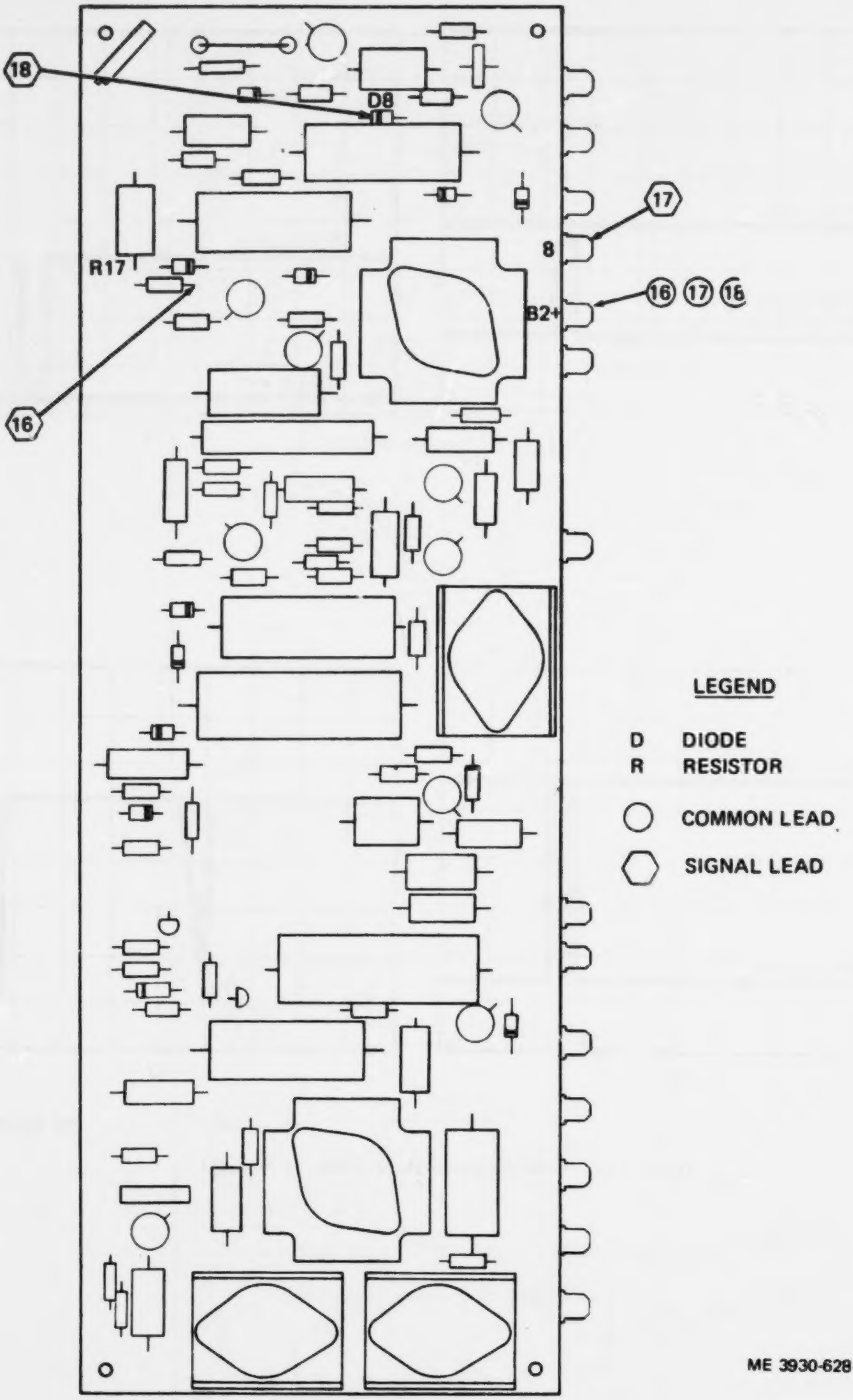
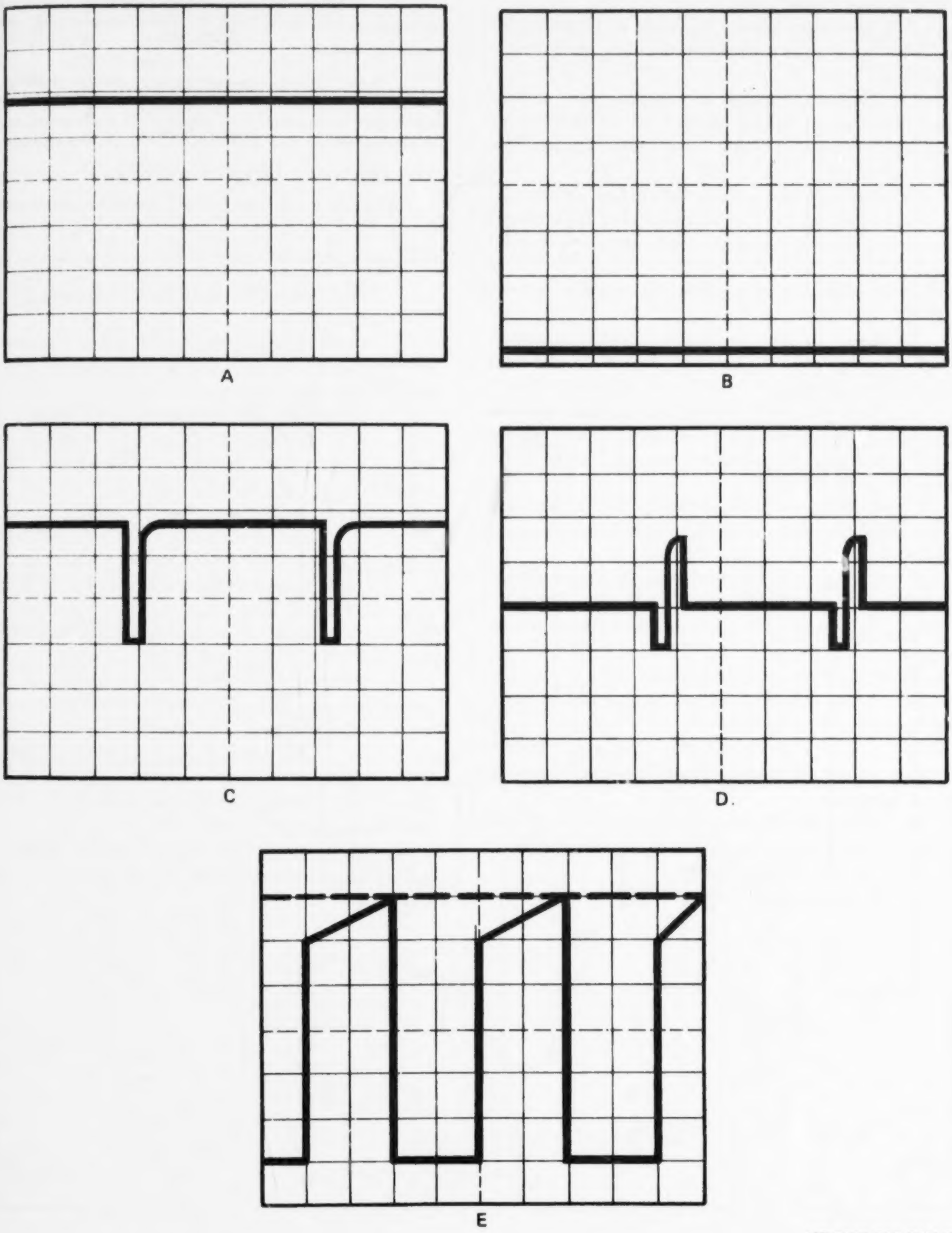

SPEED MIN
SPEED MAX
A
SPEED MAX
SPEED MIN
B
SPEED MIN
SPEED MAX
C
D
ME 3930-628-34/4-34

Figure 4-34. Oscilloscope waveshapes (tests 12 thru 15).


18
D8
17
8
16 17 18
B2+
R17
16
LEGEND
D DIODE
R RESISTOR
○ COMMON LEAD
⬡ SIGNAL LEAD

ME 3930-628-34/4-35

Figure 4-35. Control board test locations (tests 16 thru 18).



ME 3930-628-34/4-36

Figure 4-36. Oscilloscope waveshapes (tests 16 thru 18).

d. Current Limit Test.

(1) Disconnect battery connector. Connect 50 mv, 500 amp shunt between battery and truck connector.

(2) Connect probes of oscilloscope across shunt. Setting of scope should be 2 msec / cm horizontal sweep and 5 mV / cm vertical amp. The trigger is -Ve.

(3) With operator on seat, turn key switch on, place forward and reverse control lever in forward or reverse and depress brake pedal to floor to stall motor.

(4) Depress accelerator to floor until current limit is reached.

(5) Place a jumper across brake interlock switch. Repeat steps (3) and (4). Meter should read 420 to 440 amps.

(6) Remove scope probes and connect a peak battery current meter across shunt. Set meter function selector to required current range (500 amps).

(7) If reading is incorrect, adjust current limit potentiometer (R63) to bring reading into correct limits.

(8) Replace current limit potentiometer (R63) if adjustment cannot be attained.

(9) Disconnect jumper and shunt from truck circuits.

e. Inching Potentiometer Test.

(1) Truck must be raised and blocked with drive wheels clear of floor.

(2) Connect VOM positive lead to No. 3 terminal of control board. Connect negative lead to No. 2 terminal.

(3) With operator on seat place forward and reverse control lever in forward position. Meter should read full battery voltage.

(4) Depress accelerator slightly to close foot switch. Adjust inching potentiometer (R36) until voltage starts dropping to zero and truck wheels start to rotate.

Note. To adjust potentiometer, remove sealing compound from end and turn adjusting screw in or out until proper adjustment is obtained. After adjustment is obtained, seal end of potentiometer with a suitable, removable compound.

f. Protective Circuit Board Tests.

Note. Do not attempt to repair protective circuit board. If tests prove protective circuit board is defective, replace entire board.

(1) *Tripping or bias loss test.*

*(a)*Connect VOM to No. 35 terminal (fig. 4-39) and to B—.

*(b)*With operator in seat, place forward and reverse control lever in forward or reverse and turn key switch on.

(c) VOM should read approximately zero.

(d) If reading is more than 2 volts, protective circuit board is defective. Replace protective circuit board.

(2) *Shorted power switch test.*

(a) Place cardboard or insulation between contacts of forward and reverse contactors.

*(b)*Connect VOM between No. 35 terminal (fig. 4-37) and B—.

(c) Connect a jumper between No. 32 terminal (fig. 4-37) and B+.

(d) With operator in seat, turn key switch on, place directional control lever in forward or reverse and depress accelerator.

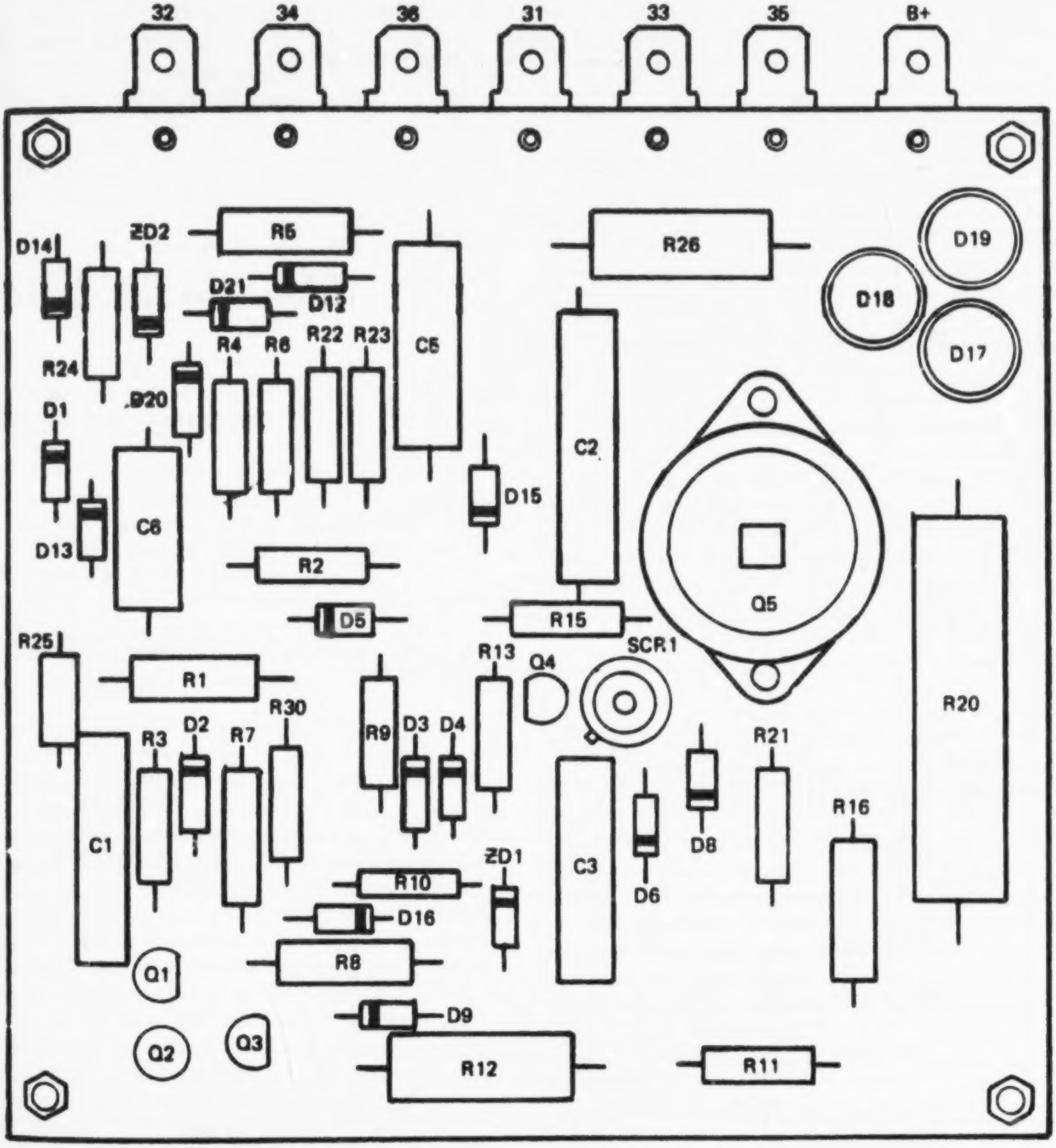
(e) VOM should read approximately zero.

(f) If reading is more than 2 volts, protective circuit board is defective. Replace protective circuit board.

(3) *Wiring diagram.* Figure 4-38 is a schematic wiring diagram of the protective circuit board.

REFERENCE DESIGNATIONS

C	CAPACITOR
D	DIODE
Q	TRANSISTOR
R	RESISTOR
Z	ZENER DIODE


32
34
36
31
33
35
B+
D14
ZD2
R5
R26
D19
D18
D17
D21
D12
R24
R4
R6
R22
R23
C5
C2
D1
D20
C6
D13
D15
R2
D5
R15
Q5
R25
R1
R13
Q4
SCR1
R30
D2
R3
R7
R9
D3
D4
R21
R20
C1
ZD1
R10
C3
D8
D6
R16
D16
R8
Q1
D9
Q2
Q3
R12
R11

ME 3930-628-34/4-37

Figure 4-37. Protective circuit board.

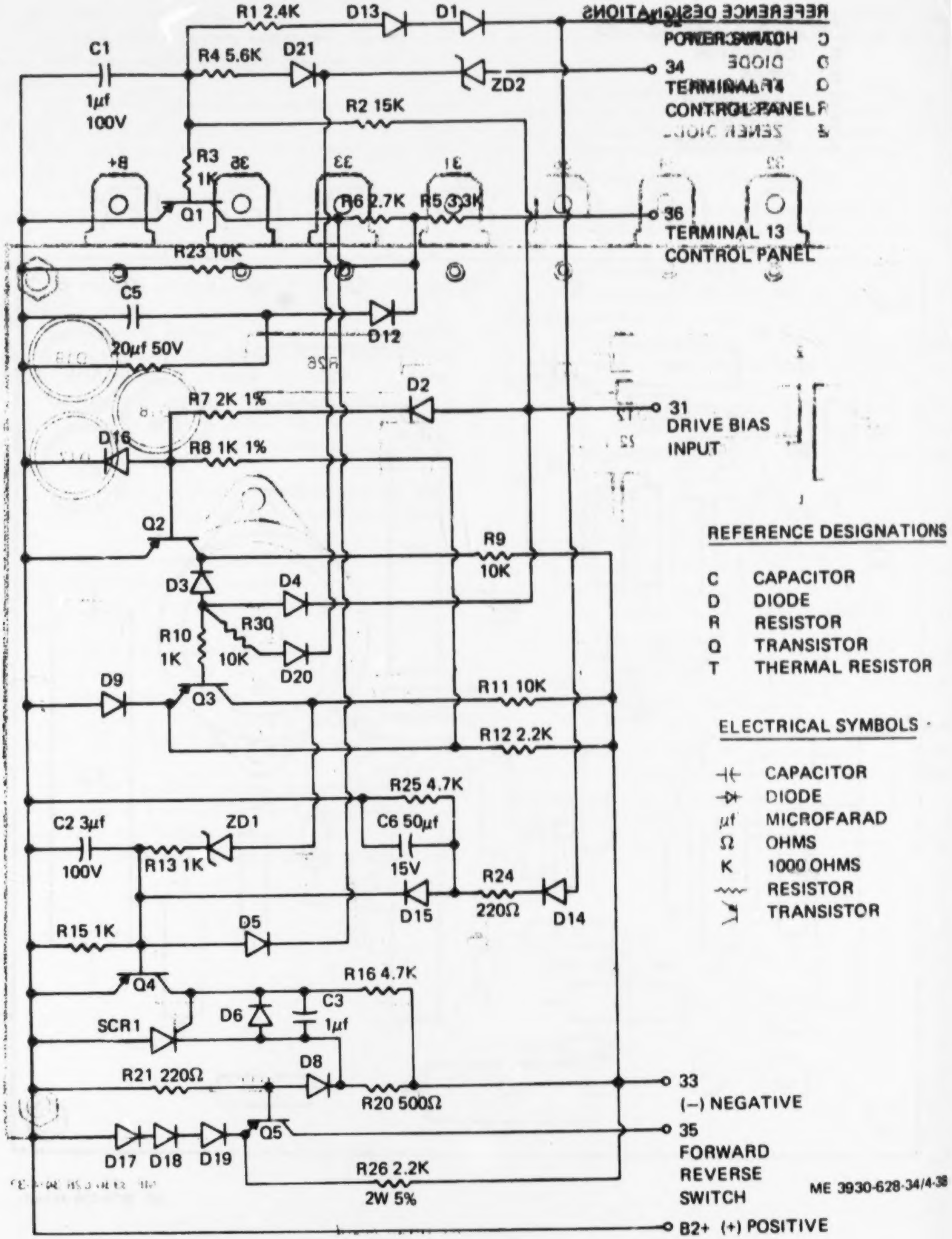

R1 2.4K
D13
D1
POWER SWITCH
C1
1µf
100V
R4 5.6K
D21
ZD2
34
TERMINAL 14
CONTROL PANEL
R2 15K
R3
1K
Q1
R6 2.7K
R5 3.3K
36
TERMINAL 13
CONTROL PANEL
R23 10K
C5
20µf 50V
D12
D2
R7 2K 1%
31
DRIVE BIAS
INPUT
D16
R8 1K 1%
Q2
R9
10K
D3
D4
R30
10K
R10
1K
D20
D9
Q3
R11 10K
R12 2.2K
R25 4.7K
C2 3µf
100V
ZD1
R13 1K
C6 50µf
15V
R24
220Ω
D15
D14
R15 1K
D5
Q4
R16 4.7K
D6
C3
1µf
SCR1
D8
R21 220Ω
R20 500Ω
33
(–) NEGATIVE
D17
D18
D19
Q5
35
FORWARD
REVERSE
SWITCH
R26 2.2K
2W 5%
B2+ (+) POSITIVE
ME 3930-628-34/4-38
REFERENCE DESIGNATIONS
C CAPACITOR
D DIODE
R RESISTOR
Q TRANSISTOR
T THERMAL RESISTOR
ELECTRICAL SYMBOLS
CAPACITOR
DIODE
µf MICROFARAD
Ω OHMS
K 1000 OHMS
RESISTOR
TRANSISTOR

Figure 4-38. Protective circuit board schematic wiring diagram.

(4) *Removal.*

(a) If testing proves protective circuit board to be defective, remove control board (*b* above).

(b) Tag and disconnect wires from protective circuit board, remove four screws and remove board.

(5) *Installation.*

(a) Connect wires to proper terminals on protective circuit board.

(b) Install protective circuit board on panel and secure with four screws.

(c) Refer to *g* below and install control board.

g. Installation.

(1) Connect all electrical leads to the control board.

(2) Refer to figure 4-25 and install the control board into the truck frame.

(3) Secure in place with three screws and lock washers.

4-22. Contactor Assembly

a. Description. The contactor assembly (fig. 4-39) consists of four contactors, one contactor controlling the hydraulic pump operation, one each for forward and reverse movement, and one contactor controlled by the emergency stop switch.

(1) The control relay of the contactor box assembly is actuated by closing the ignition switch, sitting on the seat, and selecting the desired direction of travel. The actuation of this relay causes its normally open circuits to close, and its normally closed circuits to open. This operation of the contacts inserts an economizing resistor in the circuit.

(2) Moving the forward and reverse control lever to FORWARD selects the forward contactor. Depressing the accelerator pedal opens the normally-closed contacts and closes the normally-open contacts of foot switch, one completing the circuit for the forward contactor. Current flows through the directional control switch, the interlock contacts mounted on the reverse contactor, the diode bridge block, the forward contactor coil, the now closed contacts of the foot switch, through the control relay contacts, and back to the battery.

(3) As soon as the key switch is closed, the hydraulic pump contactor is ready to operate. The closing of the switch on the hydraulic control valve linkage provides a path for current flow. Current flow is from the battery, through the pump contactor coil, the closed pump switch, and back to the battery. Actuation of the pump contactor closes its normally-open contacts permitting current flow from the battery through the pump motor back to the battery.

b. Disassembly. Refer to figure 4-39 and disassemble the contactor box assembly as follows:

(1) To remove the contactors, proceed as follows:

(2) Remove cover from contactor box. Tag and disconnect all electrical leads.

(3) Remove cable, fuses and bus bars.

(4) Remove screws, lock washers, and washers securing the contactors to the contactor box. Remove the contactors and insulation.

(5) Remove terminal blocks by removing screws and lock washers.

(6) Remove relay by removing the screw securing it to the contactor box.

(7) Remove the screw, washer and lock washer securing the rectifier to the contactor box.

(8) Remove the resistor by removing nuts, washers, lock washers and screws.

(9) Remove the diode and bracket by removing screw, lock washer and nut securing them to the contactor box. Separate the diode and bracket.

(10) Remove nuts, lock washers, washers, and screws to remove the fuse block.

c. Cleaning, Inspection and Repair.

(1) Clean all parts with a cloth dampened with cleaning solvent.

(2) Inspect the contactors for worn or pitted contacts.

(3) Check the springs on the contactors for bends, cracks or other damage which may impair good operation. If any repair is required on the contactors, refer to paragraphs 4-23 and 4-24.

(4) Check all remaining parts for damaged or worn threads, cracks, or other damage which would impair operation.

d. Assembly. Refer to figure 4-39 and assemble the contactor box assembly as follows:

(1) Secure the fuse block to the contactor box with screws, washers, lock washers and nuts. Install fuses.

(2) If the diode was removed from the bracket, secure it in place with nut, washer and lock washer. Mount the bracket and diode in contactor box.

(3) Install the rectifier and secure in place with screw, washer, and lock washer.

(4) Install the resistor in the contactor box and secure with screws, washers, lock washers and nuts.

(5) Secure the relay in place with screw.

(6) Install the terminal blocks and secure in place with screws and lock washers.

Note. In assembling contactor box assembly, do not replace brass screws and attaching parts with steel parts. Install identical parts as were removed.

(7) Place the insulation under the contactors. Secure the contactors in place with screws, washers and lock washers.

(8) Install the cable, fuse and bus bars on the contactors. Tighten screws.

(9) Install contactor box cover.

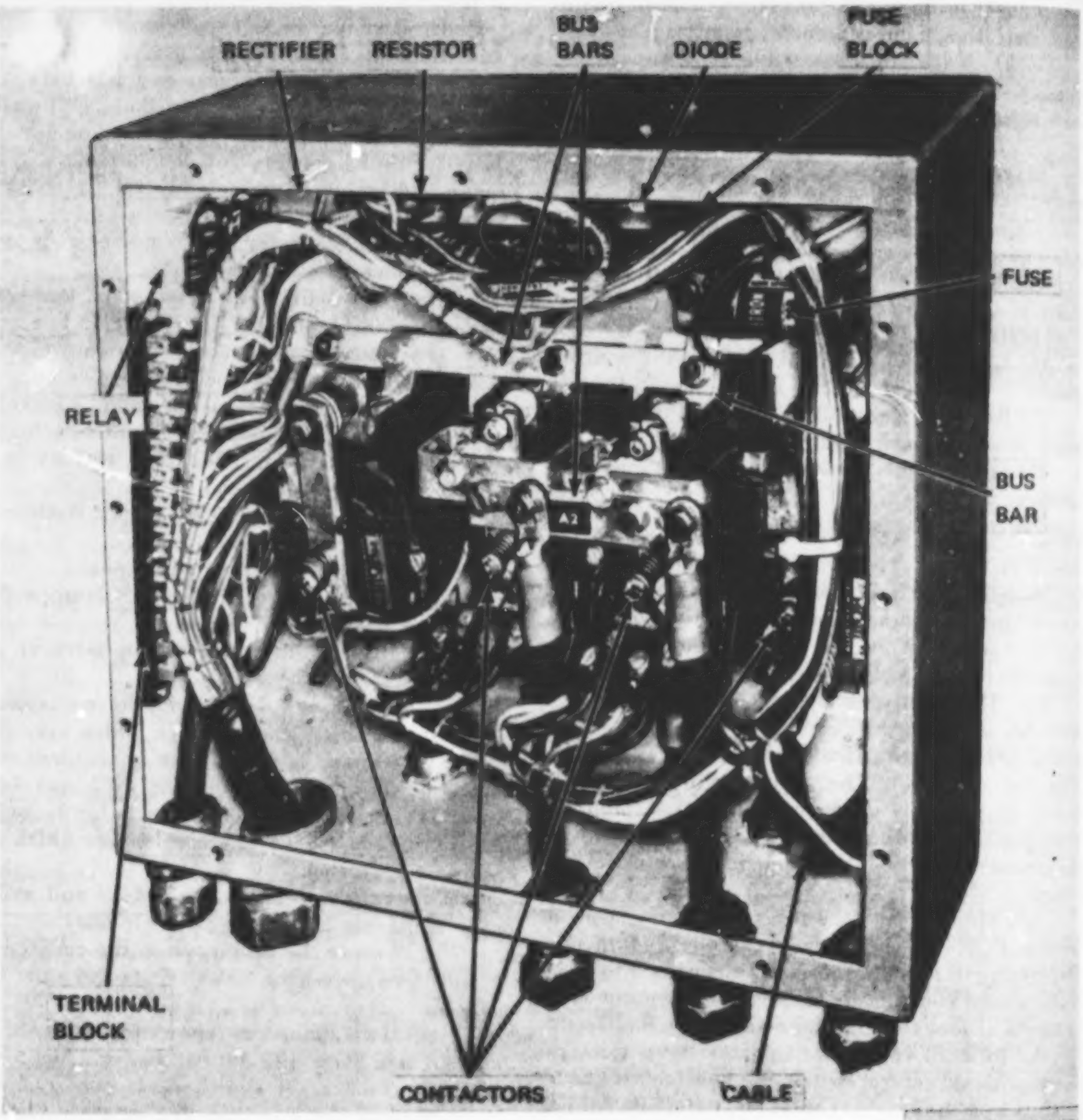

RECTIFIER
RESISTOR
BUS BARS
DIODE
FUSE BLOCK
FUSE
RELAY
BUS BAR
A2
TERMINAL BLOCK
CONTACTORS
CABLE
ME 3930-628-34/4-39

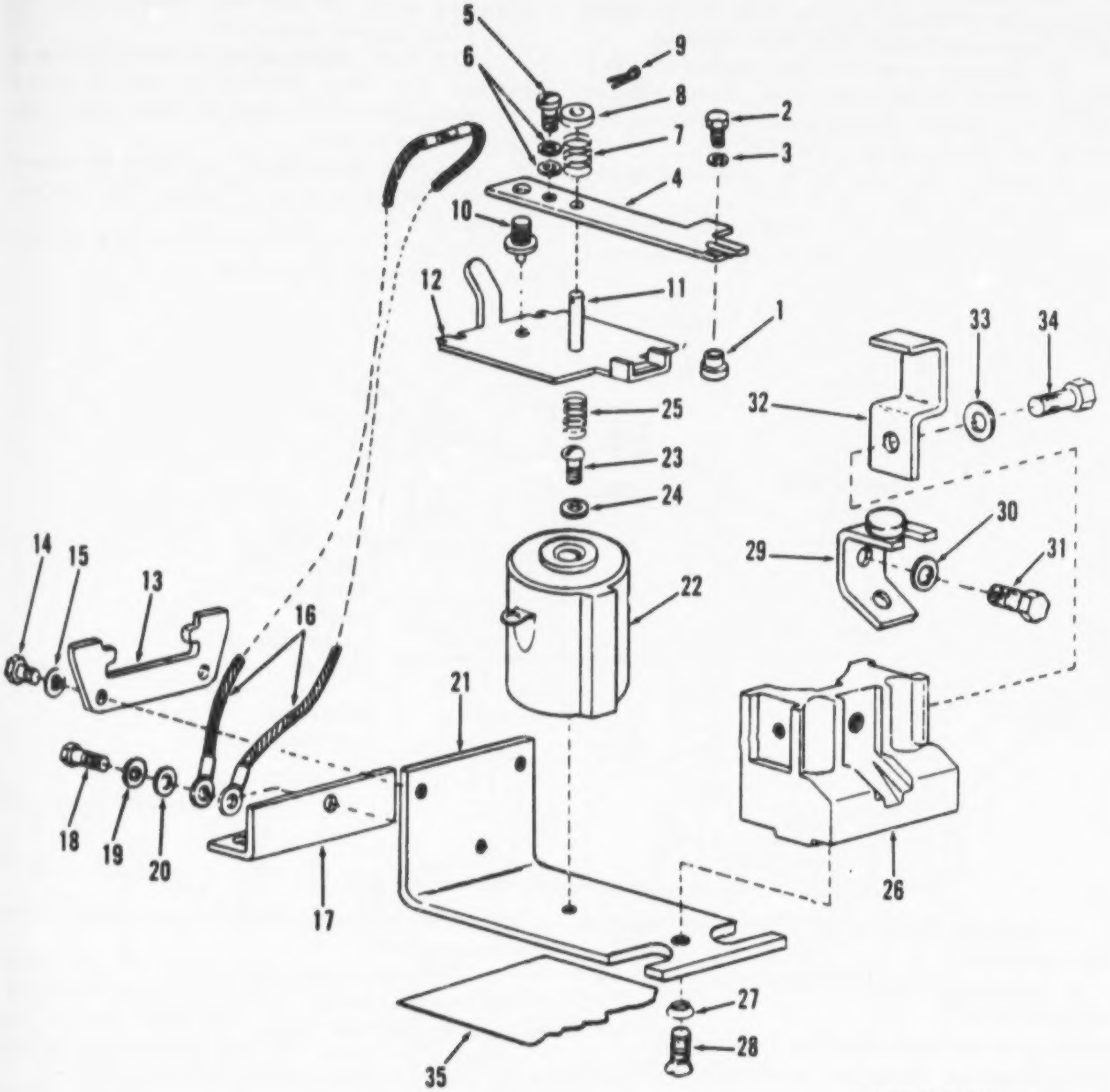
Figure 4-39. Contactor box assembly.

4-23. Hydraulic Pump and Emergency Cutout Contactors

a. Removal. Remove the contactors as outlined in paragraph 4-22. The hydraulic pump and emergency cutout contactors are identical except for the coil (22, fig. 4-40).

b. Disassembly.

(1) Remove screws (5 and 18, fig. 4-40), washers (6 and 20) and lock washers (19) to remove the lead assembly (16).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ME 3930-628-34/4-40

1. Contact
2. Screw
3. Lock washer
4. Carrier
5. Screw
6. Washer
7. Spring
8. Washer
9. Pin
10. Bearing
11. Pin
12. Armature
13. Retainer
14. Screw
15. Lock washer
16. Lead assembly
17. Terminal
18. Screw
19. Lock washer
20. Washer
21. Yoke
22. Coil
23. Screw
24. Lock washer
25. Spring
26. Block
27. Lock washer
28. Screw
29. Support
30. Washer
31. Screw
32. Bracket
33. Washer
34. Screw
35. Insulation

Figure 4-40. Hydraulic pump and emergency cutout contactor, exploded view.

(2) Remove screw (14) and washer (15) securing the armature retainer (13) to the yoke (21). Remove armature (12) from retainer.

(3) Remove screw (2) and washer (3) and remove contact (1) from carrier (4). Remove cotter pin (9), cup washers (8) and spring (7) and remove carrier (4) from armature pin (11).

(4) Remove the coil (22) by removing spring (25), screw (23) and washer (24).

(5) Remove screw (34), washer (33), bracket (32), screw (31), washer (30) and contact support (29).

(6) The control block (26) is removed by removing screw (28) and lock washer (27).

c. *Cleaning and Inspection.*

(1) Visually inspect all components for wear or damage that may prevent or impair normal operation. Check for cracked or frayed shunt wires. Replace as necessary.

(2) Check the contactor assemblies for signs of excessive arcing or pitting. Replace worn contacts (1, fig. 4-42).

(3) Refer to figure 4-41 and check the contactor for correct adjustment.

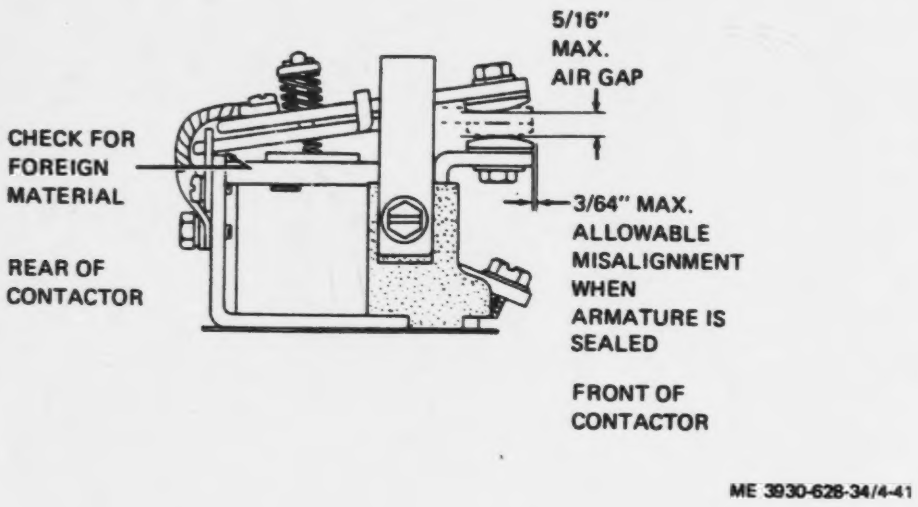

5/16" MAX. AIR GAP
CHECK FOR FOREIGN MATERIAL
3/64" MAX. ALLOWABLE MISALIGNMENT WHEN ARMATURE IS SEALED
REAR OF CONTACTOR
FRONT OF CONTACTOR
ME 3930-628-34/4-41

Figure 4-41. Contactor adjustment (typical).

d. *Assembly.* Refer to figure 4-40 and assemble the contactor in reverse order of disassembly.

e. *Installation.* Install the contactor as outlined in paragraph 4-22.

4-24. Forward and Reverse Contactors

a. *Removal.* Refer to paragraph 4-22 b for removal.

b. *Disassembly.* The forward and reverse contactors are connected by a bus bar. Separate contactors by removing screw (39, fig. 4-42), washer (40), and bus bar (41). Refer to figure 4-42 and disassemble the contactors as follows:

(1) Remove lead assembly (17) by removing screws (5 and 18), washers (6 and 19), and lock washer (7).

(2) Remove screws (21) and lock washers (22) securing the armature retainer (20) to the yoke (23). Remove the armature assembly (13).

(3) Remove limit switch (14) by removing screws (15) and washers (16).

(4) Remove cotter pin (10), washer (9), and spring (8) to remove the carrier assembly (4) from the armature.

(5) Remove nuts (2), washers (3) and contacts (1) from the carrier (4) and supports (31 and 35).

(6) Remove spring (30) from the coil core. Remove the screw (28) and washer (29) securing the coil (27) to the yoke (23). Remove the coil.

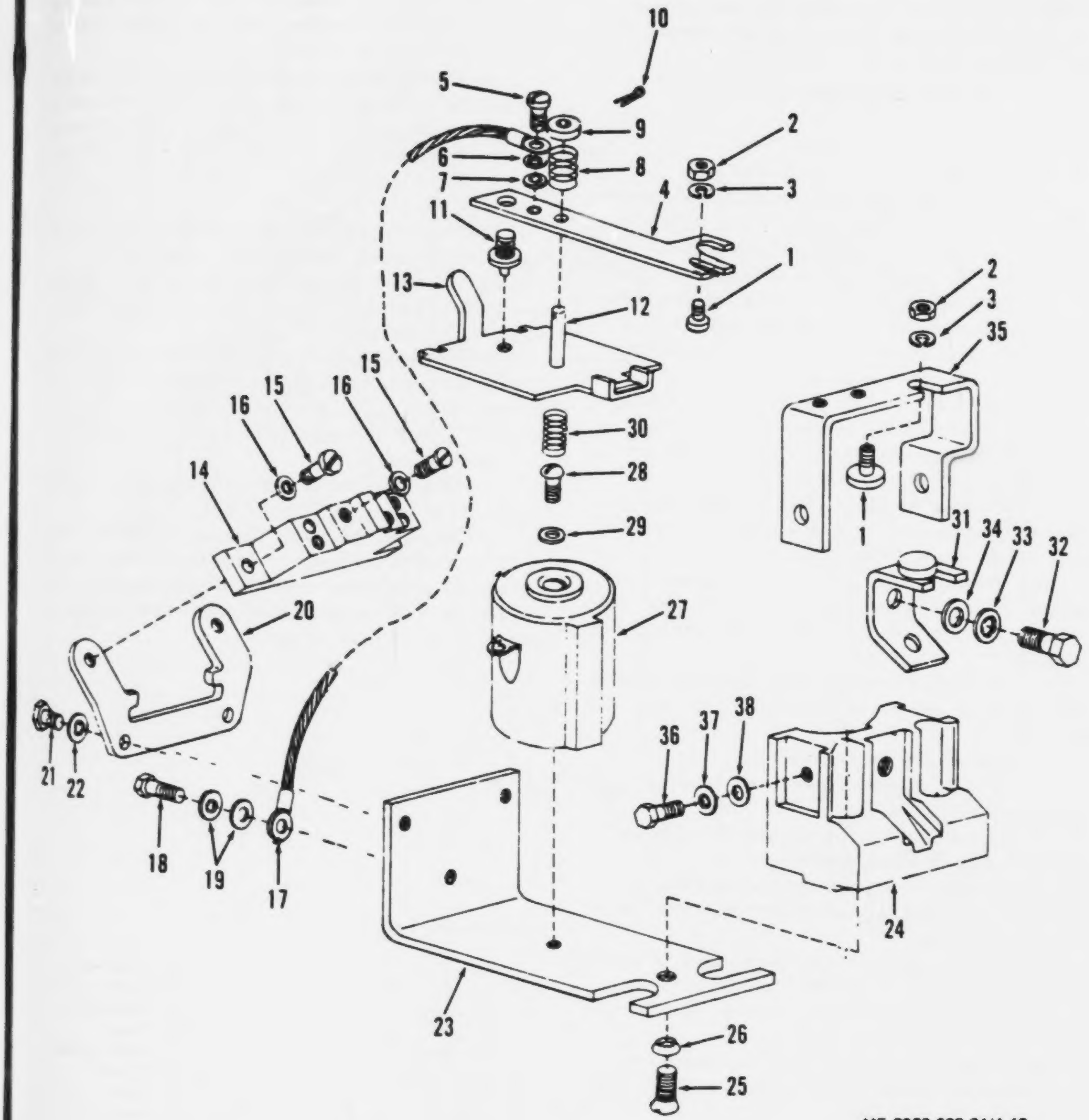
(7) Remove screw (36), washer (37) and lock washer (38) securing the support (35) to the contact block (24).

(8) Remove support (31) by removing screw (32), lock washer (33) and washer (34) from the contact block (24).

(9) The contact block (24) is removed from the yoke by removing screw (25) and lock washer (26).

c. *Cleaning and Inspection.* Refer to paragraph 4-23 c

d. *Assembly.* Refer to figure 4-42 and assemble the contactors in reverse order of disassembly.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ME 3930-628-34/4-42

1. Contact
2. Nut
3. Washer
4. Contact carrier
5. Screw
6. Washer
7. Lock washer
8. Spring
9. Washer
10. Cotter pin
11. Bearing
12. Pin
13. Armature
14. Limit switch
15. Screw
16. Lock washer
17. Lead assembly
18. Screw
19. Washer
20. Switch support
21. Screw
22. Lock washer
23. Yoke
24. Contact block
25. Screw
26. Lock washer
27. Coil
28. Screw
29. Lock washer
30. Spring
31. Support
32. Screw
33. Washer
34. Lock washer
35. Support
36. Screw
37. Washer
38. Lock washer
39. Bus bar
40. Screw
41. Washer

Figure 4-42. Forward and reverse contactor assembly.

e. Installation. Refer to paragraph 4-22 and install the contactor. Connect the two contactors together with bus bar (41, fig. 4-42), screws (39) and washers (40).

4-25. Accelerator Assembly

a. Removal.

(1) Remove the toe plate.

(2) Disconnect wires at plastic plug.

(3) Remove two screws, nuts and lock washers securing the control box to the truck frame.

b. Disassembly. Refer to figure 4-43 and disassemble the accelerator as follows:

(1) Remove screw (17), lock washer (16), cover (15) and gasket (14) from the box (1).

(2) Loosen setscrews (23 and 33) and withdraw the accelerator shaft (9).

(3) Remove screw (5), nut (7) and lock washer (6) and remove flange bearing (8).

(4) Remove spring (32), collar (34), levers (24 and 29) and speed potentiometer (41).

(5) Remove bearings (20) by removing nuts (18), lock washers (19), and screws (35) securing them to the control box (1).

(6) Remove the screw (26), spacer (28), washer (40), lock washer (39) and nut (38) securing the limit switch (27) to the control box bracket.

(7) Remove the screw (43) and lock washer (42) securing the cover standoff (25) from the control box.

c. Cleaning and Inspection.

(1) Clean all metal parts in cleaning compound, solvent (Fed. Spec. P-D-680).

(2) Check all threaded fasteners for stripped or worn threads or other damage.

(3) Inspect the bearings for scoring, nicks, excessive wear and any other defects which might impair operation.

(4) Inspect the spring for wear, lack of spring tension, nicks, dents, or other damage.

(5) Check the limit switch for proper operation.

(6) Replace defective parts as necessary.

d. Assembly. Refer to figure 4-43 and assemble the accelerator as follows:

(1) Install the cover standoff (25) and secure in place with screw (43) and lock washer (42).

(2) Secure the limit switch (27) to the mounting bracket with screws (26), spacers (28), washers (40), lock washers (39) and nuts (38).

(3) With nuts (18), lock washers (19) and screws (35), secure the bearings (20) to the control box (1).

(4) Secure the flange bearing (8) in place with screws (5), nuts (7) and washers (6).

(5) Slide the accelerator shaft (9) through the flange bearing (8) and the first bearing (20). Slide lever (24), spring (32), and collar (34) onto th shaft (9). Slide the shaft into the second bearin (20), tighten the setscrew (33) on collar (34) t secure the shaft in place.

(6) Install the speed potentiometer (41) on the mounting bracket. Mount lever (29) on potentiometer shaft and secure in place with setscrew (30) and jam nut (31). Engage lever (29) with the upper pin on lever (24).

e. Installation.

(1) Mount the speed control box on the vehicle frame with screws, washers and nuts.

(2) Connect all electrical leads and double check for possible wrong wiring connections. Connect plastic plug to harness.

(3) Secure the cover (15, fig. 4-43) and gasket (14) to the control box (1) with wasshers (16) and screws (17).

(4) Install the toe plate.

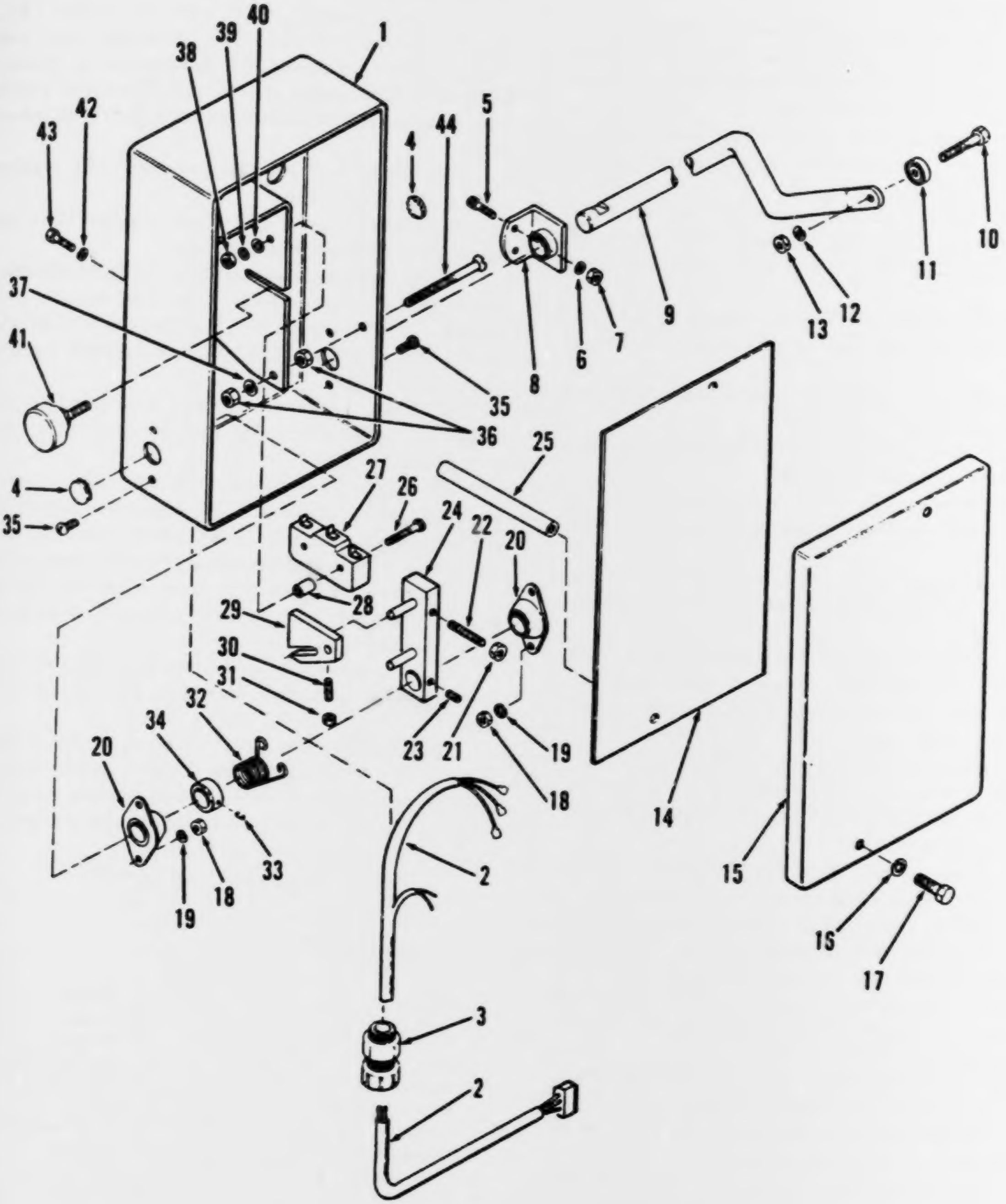
f. Adjustment.

(1) Remove the cover (15, fig. 4-43) and gasket (14) from the control box.

(2) Position the speed potentiometer (41, fig. 4-43) so that it reaches zero resistance 1/16-inch before the accelerator bearing makes contact with the toe plate. Move potentiometer (41) in or out of slot of lever (29) to adjust.

KEY to fig. 4-43:

1. Box
2. Cable
3. Connector
4. Plug
5. Screw
6. Lock washer
7. Nut
8. Bearing
9. Shaft
10. Screw
11. Bearing
12. Lock washer
13. Nut
14. Gasket
15. Cover
16. Lock washer
17. Screw
18. Nut
19. Lock washer
20. Bearing
21. Nut
22. Stud
23. Setscrew
24. Lever
25. Standoff
26. Screw
27. Limit switch
28. Spacer
29. Lever
30. Setscrew
31. Nut
32. Spring
33. Setscrew
34. Collar
35. Screw
36. Nut
37. Lock washer
38. Nut
39. Lock washer
40. Washer
41. Potentiometer
42. Lock washer
43. Screw
44. Screw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ME 3930-628-34/4-43

Figure 4-43. Accelerator assembly, exploded view.

4-26. Forward and Reverse Control Switch

a. *Removal.*

(1) Remove instrument panel cover.

(2) Drive out spring pins from tube which connects forward and reverse control lever to switch shaft. Remove lever and tube.

(3) Remove three screws and lock washers holding switch box assembly to top of instrument panel.

(4) Pull switch box assembly out of panel compartment. Tag and disconnect wires from switch terminals. Remove switch assembly from box.

b. *Disassembly.* Refer to figure 4-44 and disassemble forward and reverse control switch as follows:

(1) Remove nuts (1), lock washers (2) and washers (3) from studs (4).

(2) Remove bottom plate (5), insulator plate (6), rivnut (7) and tubes (8).

(3) Drive out pin (9). Remove plate (10) and remove studs (4) from upper plate (10). Remove cover (11).

(4) Remove nuts (12), washers (13), lock washers (14) and shorting bar (15) from terminal screws (19).

(5) Unhook springs (16) and remove roller arms (17) from bottom of upper plate (10).

(6) Remove base block (18). Remove screws (19) from base block (26).

(7) Disassemble finger assemblies (20, fig. 4-44) only if parts are to be replaced. Drill out rivet (21). Remove spring (22), support (23, finger (24) and contact strip (25).

(8) Remove nut (27), lock washer (28) and washer (29). Remove bearing (30), washer (31), bushing (33), spacer (32), contact segments (34 and 36), bushing (35), bushing (37 and 39), spacer (38), wheel (40) and top bearing (41) from shaft (42). Note position of counter punch marks on wheel and segments before removal.

c. *Cleaning and Inspection.*

(1) Clean all metal parts in cleaning compound, solvent (Fed. Spec. P-D-680).

(2) Check threaded fasteners for stripped or worn threads or other damage.

(3) Check bearings (30 and 41, fig. 4-44) for scoring, nicks, excessive wear or other defects.

(4) Check springs (16 and 22) for wear, lack of tension or weakness.

(5) Replace damaged or defective parts.

d. *Assembly.* Refer to figure 4-44 and assemble the directional control switch as follows:

(1) Assemble shaft as follows: Install the top bearing (41) and insert pin (9) to hold it in position.

(2) Install wheel (40) with wheel pin pointing in same direction as when removed. Notice position of counterpunch mark.

(3) Install bushings (37 and 39), spacer (38) upper contact segment (36), bushing (35) and lower contact segment (34). Bent edges of contact segments must point downward. Counter punch marks on segments must align with mark on wheel (40).

(4) Install bushing (33), spacer (32), washer (31) and bearing (30).

(5) Install washer (29), lock washer (28) and nuts (27). Tighten nut securely.

(6) Install finger assemblies (20) and shorting strips (15) on base blocks (26) and secure with screws (19), washers (13), lock washers (14) and nuts (12). Shorting strip (15) is located against inner nut.

(7) Install roller arms (17) over pins on the bottom of upper plate (10) and hook springs (16) into place.

(8) Align base blocks (18 and 26). Install studs (4) in upper plate (10). Assemble switch by aligning studs (4) with base blocks and placing plates (10 and 5) and insulator (6) over shaft ends.

(9) Install washers (3), lock washers (2) and nuts (1). Tighten nuts securely. Install cover (11).

e. *Installation.*

(1) Place switch assembly into switch box. Connect wires to switch terminals and secure with nuts.

(2) Align three holes in switch upper plate with those in box and top of instrument panel. Install three screws and lock washers and tighten securely.

(3) Install control lever and tube on switch shaft and drive in two spring pins.

(4) Install instrument panel cover.

KEY to fig. 4-44:

1. Nut
2. Lock washer
3. Washer
4. Stud
5. Bottom plate
6. Insulating plate
7. Rivnut
8. Insulating tube
9. Pin
10. Upper plate
11. Cover
12. Nut
13. Washer
14. Lock washer
15. Shorting bar
16. Spring
17. Roller arm
18. Base block
19. Screw
20. Finger assembly
21. Rivet
22. Spring
23. Finger
24. Support
25. Contact strip
26. Base block
27. Nut
28. Lock washer
29. Washer
30. Bearing
31. Washer
32. Spacer
33. Bushing
34. Contact segment
35. Bushing
36. Contact segment
37. Bushing
38. Spacer
39. Bushing
40. Wheel
41. Bearing
42. Shaft

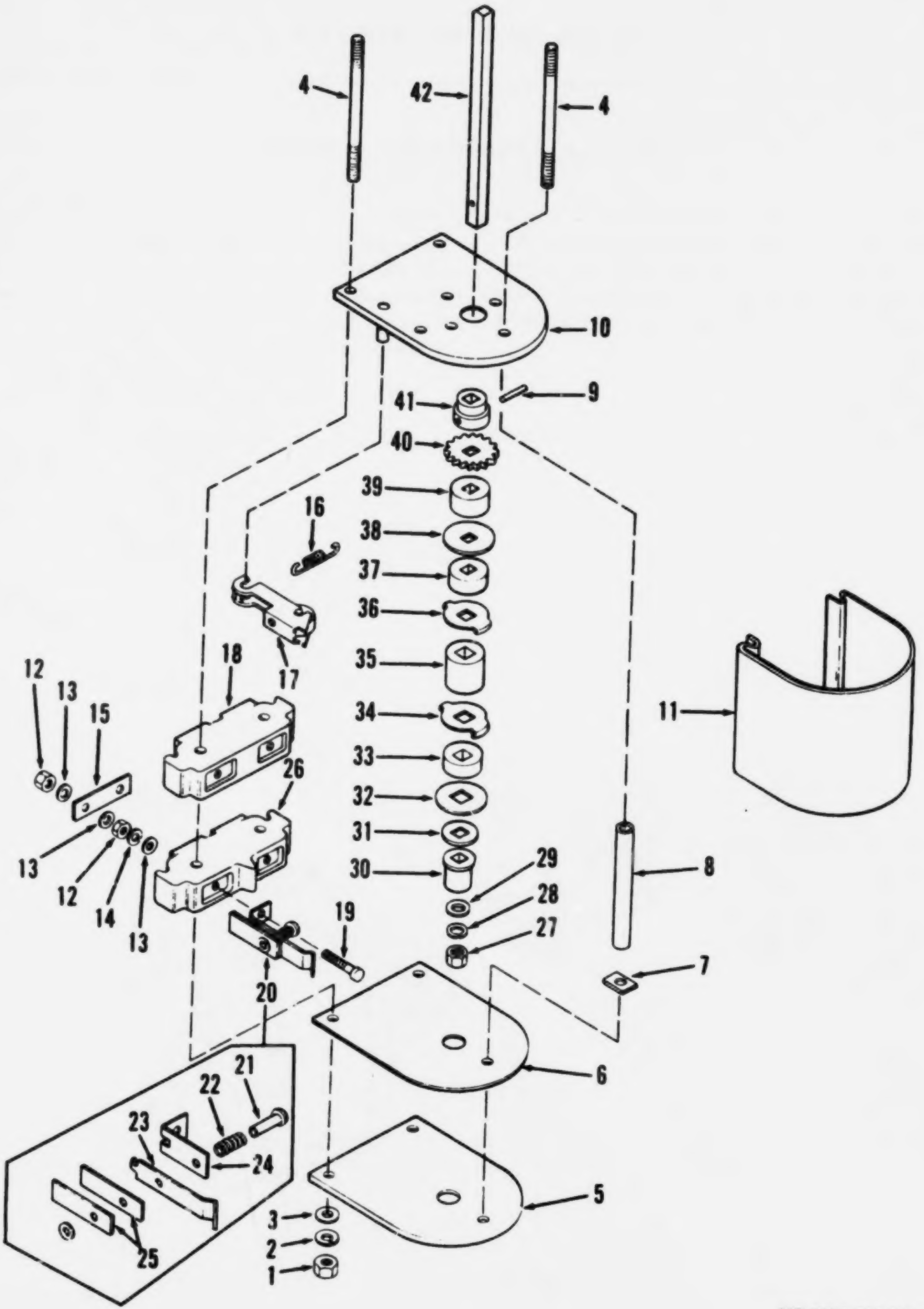
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Figure 4-44. Forward and reverse control switch, exploded view.

CHAPTER 5

REPAIR OF THE AXLES

Section I. DRIVE AXLE ASSEMBLY

5-1. Description

The drive axle assembly consists of a differential assembly, two axle shafts, and two spindles (fig. 5-1). The axle shafts connect the differential assembly (first reduction) and the bull gear (second reduction) in the drive wheel. The drive wheel rotates around a spindle, which is mounted to the axle housing. The differential assembly consists of a carrier assembly and a case assembly. The carrier assembly is mounted at the center of the drive axle housing and supports the case assembly.

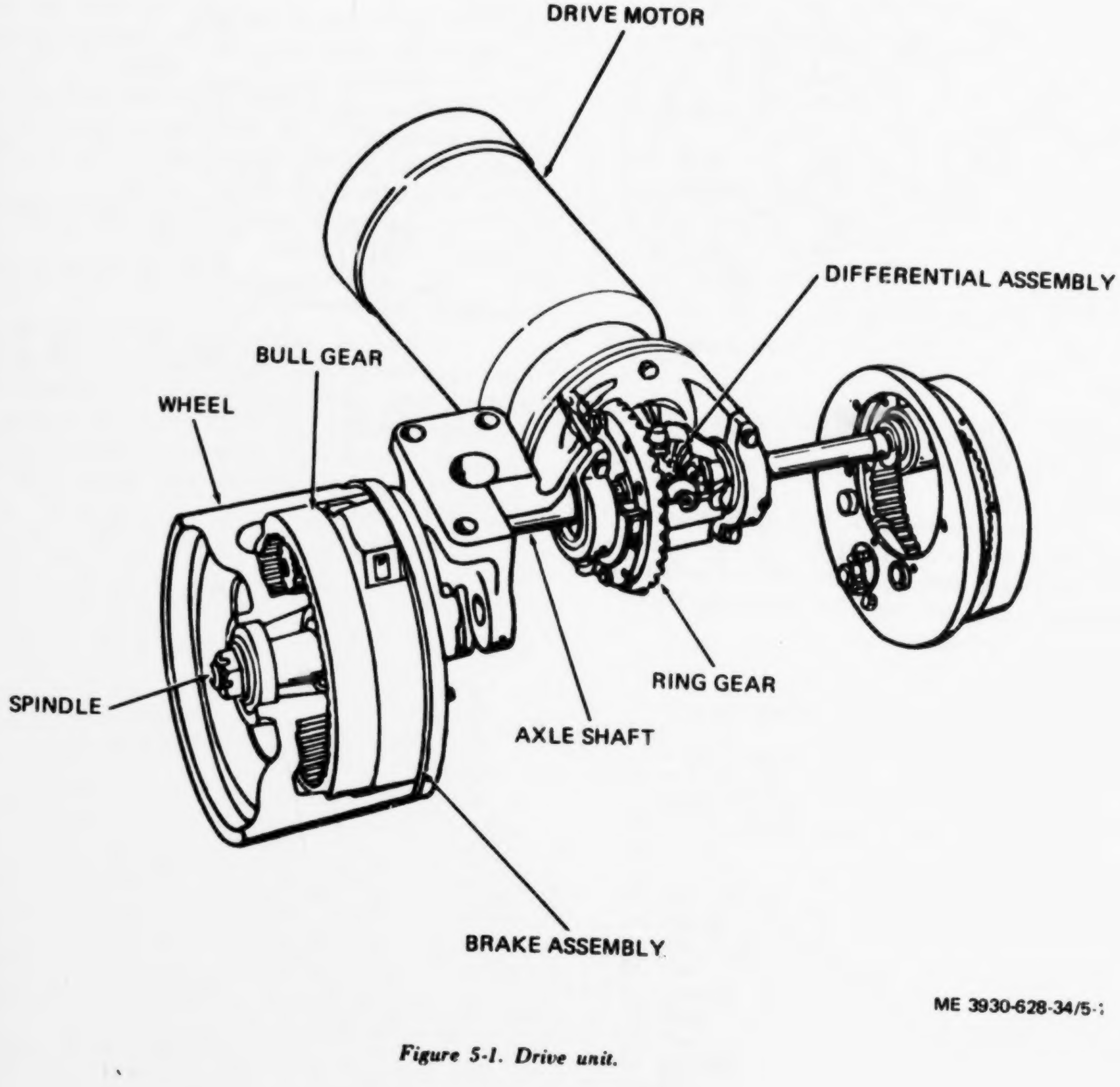

DRIVE MOTOR
DIFFERENTIAL ASSEMBLY
BULL GEAR
WHEEL
SPINDLE
RING GEAR
AXLE SHAFT
BRAKE ASSEMBLY
ME 3930-628-34/5-:

Figure 5-1. Drive unit.

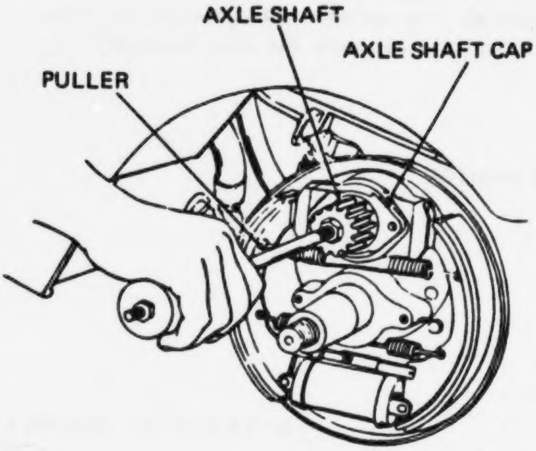
5-2. Axle Shaft

a. Removal and Disassembly.

(1) Remove drive wheel and dust shield (TM 10-3930-628-12).

(2) Remove screws (17), fig. 5-3) and lock washers (18) attaching bearing retainer (19).

(3) Install threaded puller (fig. 5-2) in threaded end of axle shaft and carefully remove shaft with bearing cap and bearing attached.



ME 3930-628-34/5-2

Figure 5-2. Pulling axle shaft.

(4) Straighten locking prongs on key washer (24, fig. 5-3).

(5) Remove nut (25) and slide washers (23 and 24) from axle shaft (16).

(6) Using suitable press, remove bearing cone assembly (21) and cup (22) from shaft.

(7) Remove oil seal (20) and retainer (19) from shaft. Discard oil seal.

b. Cleaning, Inspection and Repair.

(1) Clean all parts with cleaning compound, solvent (Fed. Spec. P-D-680). Dry thoroughly with compressed air.

(2) Inspect all parts for excessive wear or damage.

(3) Replace oil seal. Replace other worn or damaged parts as authorized.

(4) Grease bearings and shaft pinions (TM 10-3930-628-12).

c. Assembly and Installation.

(1) Refer to figure 5-3 and assemble and install axle shaft as follows:

(2) Slide retainer (19), new oil seal (20), and greased bearing assembly (21 and 22) on axle shaft (16).

(3) Align keyed washers (23 and 24) with groove in shaft (16) and slide into position on shaft.

(4) Tighten nut (25) on shaft.

(5) To assure that cone assembly (21) contacts keyed washer (23), hold bearing cup (22) in a fixed position and tap the splined end of the axle shaft (16) with a wooden mallet.

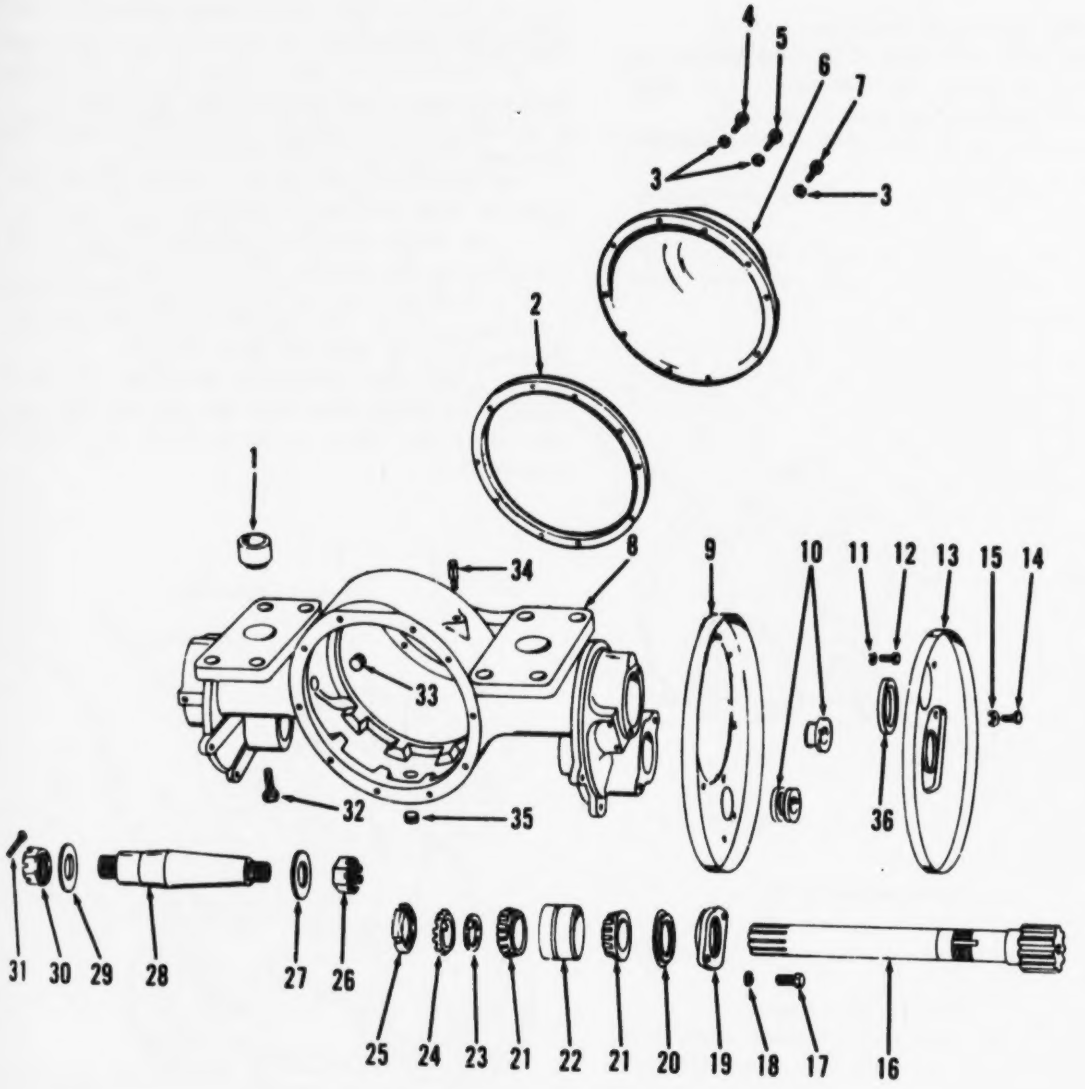
(6) Check cone assembly (21) for free rotation without drag.

Note. A slight amount of end play (0.005 of an inch maximum) is permissible.

(7) Position axle shaft (16) in housing (8) against differential. Align splines and, using a soft mallet, drive axle shaft splines into differential.

(8) Install retainer (19) to drive housing (8) and secure with lock washers (18) and screw (17).

(9) Install dust shield and drive wheel (TM 10-3930-628-12).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ME 3930-628-34/5-3

1. Pin
2. Gasket
3. Lock washer
4. Bolt
5. Bolt
6. Cover
7. Screw
8. Housing
9. Plate
10. Plug
11. Lock washer
12. Bolt
13. Dust shield
14. Screw
15. Lock washer
16. Axle shaft
17. Screw
18. Lock washer
19. Bearing retainer
20. Oil seal
21. Cone assembly
22. Bearing cup
23. Keyed washer
24. Keyed, external tooth, washer
25. Nut
26. Nut
27. Flat washer
28. Spindle
29. Flat washer
30. Nut
31. Cotter pin
32. Bolt
33. Plug
34. Breather
35. Plug
36. Oil seal

Figure 5-3. Drive axle housing and shaft, exploded view.

5-3. Spindle

a. Removal.

(1) Remove drive wheel assembly and dust shield (TM 10-3930-628-12).

(2) Refer to figure 5-3 and remove spindle from housing as follows:

(3) Loosen self-locking nut (26) approximately three turns.

(4) Install suitable puller (fig. 5-4) and remove spindle (28, fig. 5-3) from axle part way until spindle is loose in housing.

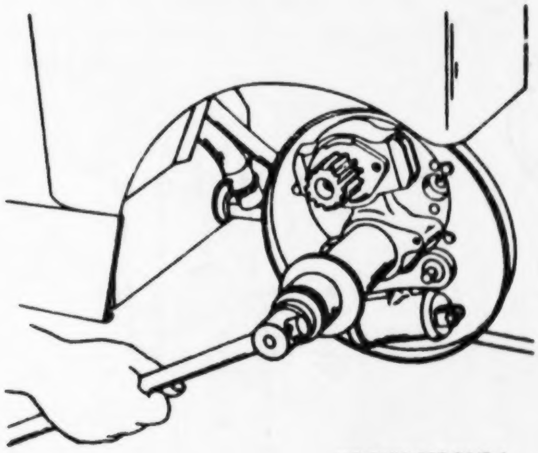

ME 3930-628-34/5-4

Figure 5-4. Removing spindle.

(5) Remove self-locking nut (26) and flat washer (27) from spindle. Using puller, pull spindle from axle.

b. Cleaning, Inspection and Repair.

(1) Clean all parts with cleaning compound, solvent (Fed. Spec. P-D-680). Dry thoroughly with compressed air.

(2) Inspect spindle and attaching parts for damage.

(3) Replace damaged parts as authorized.

c. Installation.

(1) Refer to figure 5-3 and install spindle as follows:

(2) Aline spindle (28) in housing (8) and secure it to inside of housing with washer (27) and self-locking nut (26). Tighten nut until spindle is completely seated in axle.

(3) Install dust shield and drive wheel (TM 10-3930-628-12).

5-4. Differential Assembly

a. Removal. Refer to paragraph 2-8 and remove drive motor and axle. Refer to paragraph 2-6 and remove drive motor.

b. Disassembly.

(1) Remove drive wheels from axles (TM 10-3930-628-12).

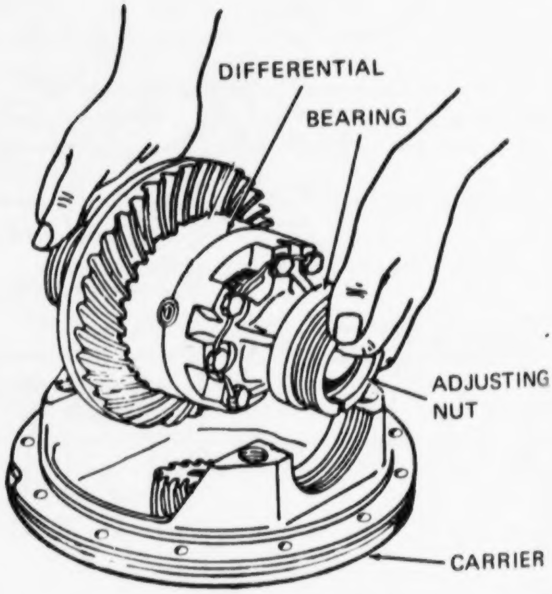
(2) Remove axle shafts (para 5-2 *a*) and drain lubricant from axle housing. Refer to paragraph 4-2 and remove drive motor and differential from axle and differential from drive motor.

(3) Refer to figure 5-6 and remove differential assembly from carrier as follows:

(a) Mark caps and differential carrier to provide identification for proper installation.

(b) Remove lock wire (11) and remove bolts (10), screws (3) and locks (12) from carrier. Remove bearing caps (4) from carrier.

(c) Remove differential assembly (15) with attached adjusting nuts, bearings, and bearing cups (fig. 5-5) and place in clean area for further disassembly.



ME 3930-628-34/5-5

Figure 5-5. Removing differential from carrier.

(d) Remove lock wire (13, fig. 5-6) and screw (14) attaching ring gear portion of ring gear and pinion (5) to flanged case half. Remove ring gear from differential assembly (15). Remove pins (26) from ring gear.

Note. Ring gear and pinion (5) are a matched set.

(6) Refer to figure 5-6 and disassemble differential assembly (15) as follows:

(a) Remove adjusting nuts (6) and, using bearing puller, remove side bearing cones (7) from case halves (21).

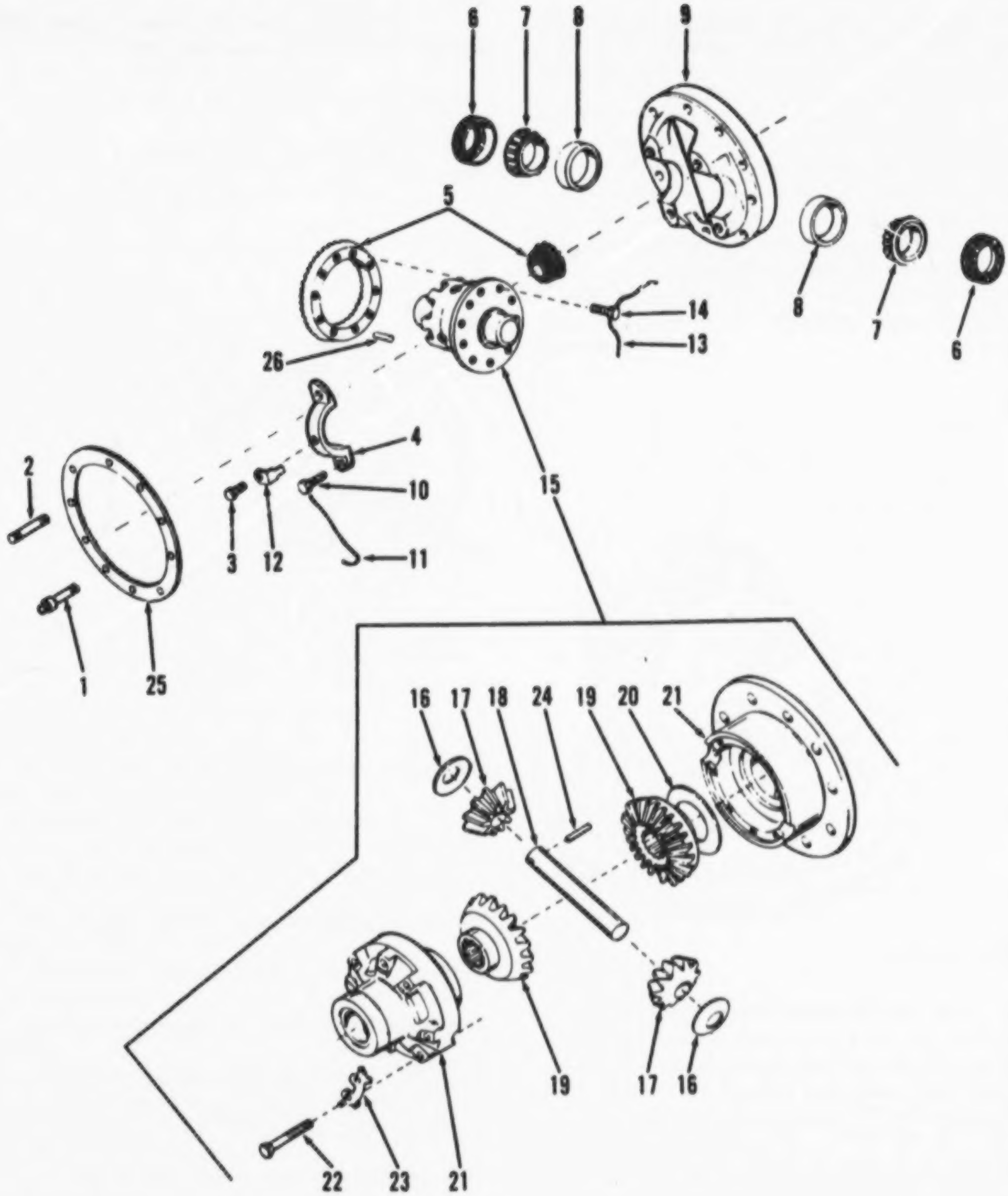
(b) Remove side bearing cups (8).

(c) Remove lock clips (23) and screws (22) holding halves (21) together and remove plain case half.

Note. One case half is flanged and the other plain. Case halves must be marked for proper assembly.

(d) Remove pinion gear thrust washers (16), and pinion gears (17) from pin (18). Remove pin (24).

(e) Remove side gear thrust washers (20), side gears (19), and cross pin (18).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ME 3930-628-34/5-6

Figure 5-6. Differential assembly, exploded view.

KEY to fig. 5-6:

1. Stud
2. Stud
3. Screw
4. Bearing cap
5. Ring gear and pinion
6. Adjusting nut
7. Side bearing cone
8. Side bearing cup
9. Carrier
10. Bolt
11. Lock wire
12. Lock
13. Lock wire
14. Screw
15. Differential assembly
16. Thrust washer
17. Pinion gear
18. Cross pin
19. Side gear
20. Thrust washer
21. Case assembly
22. Screw
23. Lock clip
24. Pin
25. Gasket
26. Spring pin

b. Cleaning, Inspection and Repair.

(1) Clean all parts with cleaning compound, solvent (Fed. Spec. P-D-680). Dry thoroughly with compressed air.

(2) Inspect all parts for cracks, chips, excessive wear or other damage.

(3) Pinion and ring gear must be replaced as a set.

(4) Replace all oil seals and gaskets. Replace all other parts as authorized.

c Assembly and Adjustment.

(1) Refer to figure 5-6 and assemble differential assembly as follows:

(2) Assemble differential assembly (15) as follows:

(a) Install pin (24) in flanged case half. Position pin (18), side gears (19), and side gear thrust washers (20) in flanged case half.

(b) Install pinion gears (17), and pinion gear thrust washers (16) on pin (18). Check for proper gear mesh. Install pin (24).

(c) Align plain and flanged case halves (21) match marks and join case halves. Secure halves with screws (22) and lock clips (23).

(d) Press side bearing cups (8) and side bearing cones (7) on both halves of case (21) and install, but do not tighten, adjusting nuts (6).

(3) Assemble carrier assembly as follows:

(a) Install pins (26) in flange. Install ring gear portion of ring gear and pinion (5) on flanged case half (21) and secure with screws (14) and lock wire (13).

(b) Position differential assembly in carrier (9) and install bearing caps (4) and secure with four bolts (10). Do not tighten bolts. Caps must be installed as marked at disassembly.

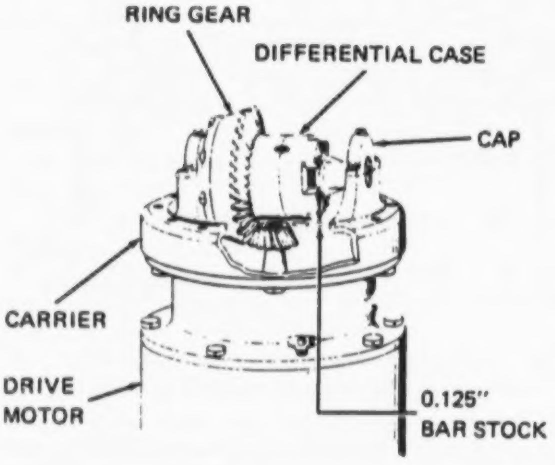
(c) Turn adjusting nut on ring gear side of differential to right to loosen as far as possible.

(d) Turn adjusting nut on opposite side to right to tighten as far as possible.

(e) Wrap a cord around differential case and attach a spring scale to loose end of cord. Pull gradually on scale and note effort required to rotate differential assembly. Case should start to rotate at less than 3 pounds pull.

(4) *Measure for shim thickness.*

(a) Install carrier assembly on drive motor (9, fig. 4-1) without shims (6). Place a piece of bar stock approximately 0.125 inch thick on pinion gear (fig. 5-7). Measure thickness of bar stock accurately.



ME 3930-628-34/5-7

Figure 5-7. Measuring for shims.

(b) Use a feeler gage and measure the distance between the bar stock and the differential case. Add thickness of bar stock to feeler gage thickness.

(c) Check pinion and ring gear for an etched measurement. They must be the same. If they are marked with a plus (+), add the measurement to 0.156. If marked with a minus (—), subtract from 0.156.

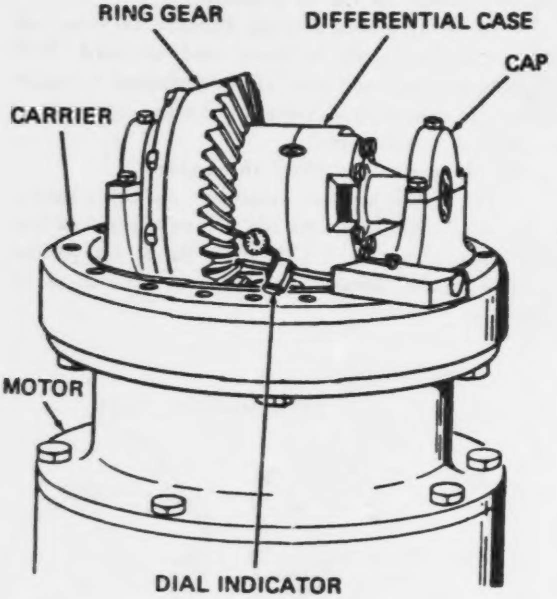
(d) Subtract sum of bar stock and feeler gage thickness from total found in (c) above. This difference will be the shim thickness required.

(e) Remove carrier from drive motor, install required shims (6, fig. 4-1) to total thickness required. Install carrier assembly on motor and secure with four screws and lock washers.

(5) *Check backlash.*

(a) Using a dial indicator as shown on figure

5-8, check ring gear for backlash at four equally spaced positions on ring gear. Backlash should be between 0.005 and 0.010 inch.



ME 3930-628-34/5-8

Figure 5-8. Checking backlash.

(b) To increase backlash loosen bearing adjusting nut nearest to ring gear and tighten opposite nut. To decrease loosen adjusting nut farthest from ring gear and tighten opposite nut.

Note. When adjusting backlash, turn adjusting nuts exact equal distance to maintain proper bearing preload.

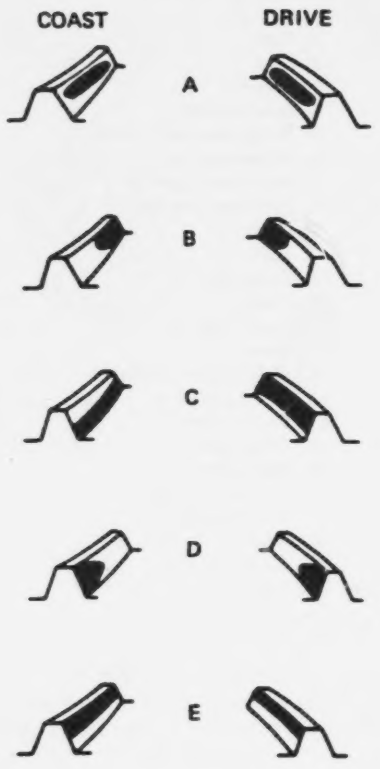
(6) *Check gear teeth pattern.*

(a) Coat entire ring gear with Prussian Blue or white lead.

(b) Rotate ring gear (2) several times, holding back on pinion to create load effect.

(c) Inspect teeth of pinion and compare with figure 5-9. Tooth bearing should start 1 / 32 to 1 / 16 of an inch from the top of the tooth and continue down to an equivalent distance from the bottom of the tooth.

Note. Do not be concerned about the amount of paint removed. This will vary with load applied.



A – CORRECT ADJUSTMENT.
B – HEAVY CONTACT ON TOE OF TOOTH. TO CORRECT MOVE RING GEAR AWAY FROM PINION. MOVE PINION TOWARDS RING GEAR TO AGAIN SECURE CORRECT BACKLASH.
C – BEARING TOO LOW. HEAVY CONTACT ON FLANK OF TOOTH. TO CORRECT THIS MOVE PINION AWAY FROM RING GEAR UNTIL CONTACT COMES TO FULL WORKING DEPTH OF GEAR TOOTH WITHOUT BREAKING CONTACT AT FLANK. MOVE RING GEAR TOWARDS PINION TO SECURE PROPER BACKLASH.
D – HEAVY CONTACT AT HEEL OF TOOTH TO CORRECT MOVE RING GEAR TOWARDS PINION. MOVE PINION AWAY FROM GEAR TO OBTAIN CORRECT BACKLASH.
E – SHOWS HEAVY CONTACT ON TOOTH FACE. MOVE PINION TOWARDS GEAR UNTIL CONTACT COVERS FLANK OF TOOTH WITHOUT BREAKING CONTACT AT FACE. MOVE GEAR AWAY FROM PINION TO SECURE CORRECT BACKLASH.

ME 3930-628-34/5-9

Figure 5-9. Differential gear tooth patterns.

(d) Secure caps with locks (12, fig. 5-6), and screws (3 and 10). Secure screws with lock wire (11).

(6) Refer to paragraph 4-28 and install drive motor with carrier attached on drive axle.

(7) Install axle shafts (para 5-2 *c*) and lubricate (LO 10-3930-628-12).

(8) Install dust shield and drive wheel assemblies (TM 10-3930-628-12).

Section II. STEERING AXLE

5-5. Description

The cruciform, trunnion mounted steering axle is mounted in lubricated self-aligning sleeve bearings. A manually operated control unit pivots an arm that moves tie rods connected to the spindles, on which the rear wheels are mounted.

5-6. Removal

a. Refer to figure 5-10 and remove axle as follows:

b. Raise rear end of truck with suitable hoist to a height at which access can be obtained to the steering axle. Support in this position with blocks or other authorized safe means. Remove wheels (TM 10-3930-628-12).

c. Place a suitable jack under steering axle and raise it slightly to relieve stress on mounting bearings.

d. Disconnect steering tie rod assembly (18) from ball stud on pivot arm (26) by removing cotter pin (16) at end of tie rod assembly (18) and loosening adjusting plug (17).

e. Loosen adjusting screw nut (2) and back off adjusting screw (1) to free axle.

f. Remove screws (4), lock washers (5), and nuts (6) attaching bearing housings (9) to trunnion blocks.

g. Slowly lower axle assembly, with tie rods attached, to ground.

h. Remove spacers (7 and 8) from bearing housings (9).

5-7. Disassembly

a. Refer to figure 5-10 and disassemble axle as follows:

b. Remove and disassemble both tie rod assemblies as follows:

(1) Remove cotter pin (12), nut (13), and flat washer (14) from bottom of tie rod end (15).

(2) Remove cotter pin (16) and loosen adjusting plug (17).

(3) Remove tie rod assemblies (18).

(4) Remove adjusting plug (17), ball seat (19), spring (20) from tie rods (21).

(5) Slip cover (22) from tie rod end (15).

(6) Loosen jam nut (23) on tie rod end (15) and remove tie rod end from tie rods (21).

(7) Remove lubrication fittings (24 and 25) from rods (21) and tie rod ends (15).

c. Disassemble bearing housing (9) as follows:

(1) Remove bearing (11) from housing (9).

(2) Remove lubrication fitting (10) from top of housing.

d. Remove pivot arm (26) from steering axle (27) as follows:

(1) Remove staked nut (28), washer (29), seal (30) and bearing cone (31).

(2) Remove pivot arm (26) from axle and bearing cup (32) and remove bearing cone (33) and seal (34) from pivot arm (26).

(3) Remove bearing cups (32 and 35) and retaining ring (36) from axle if replacement is necessary.

(4) Remove adjusting screws (37 and nuts (38) from pivot arm (26).

e. Remove king pins (39) and spindles (40 and 41) as follows:

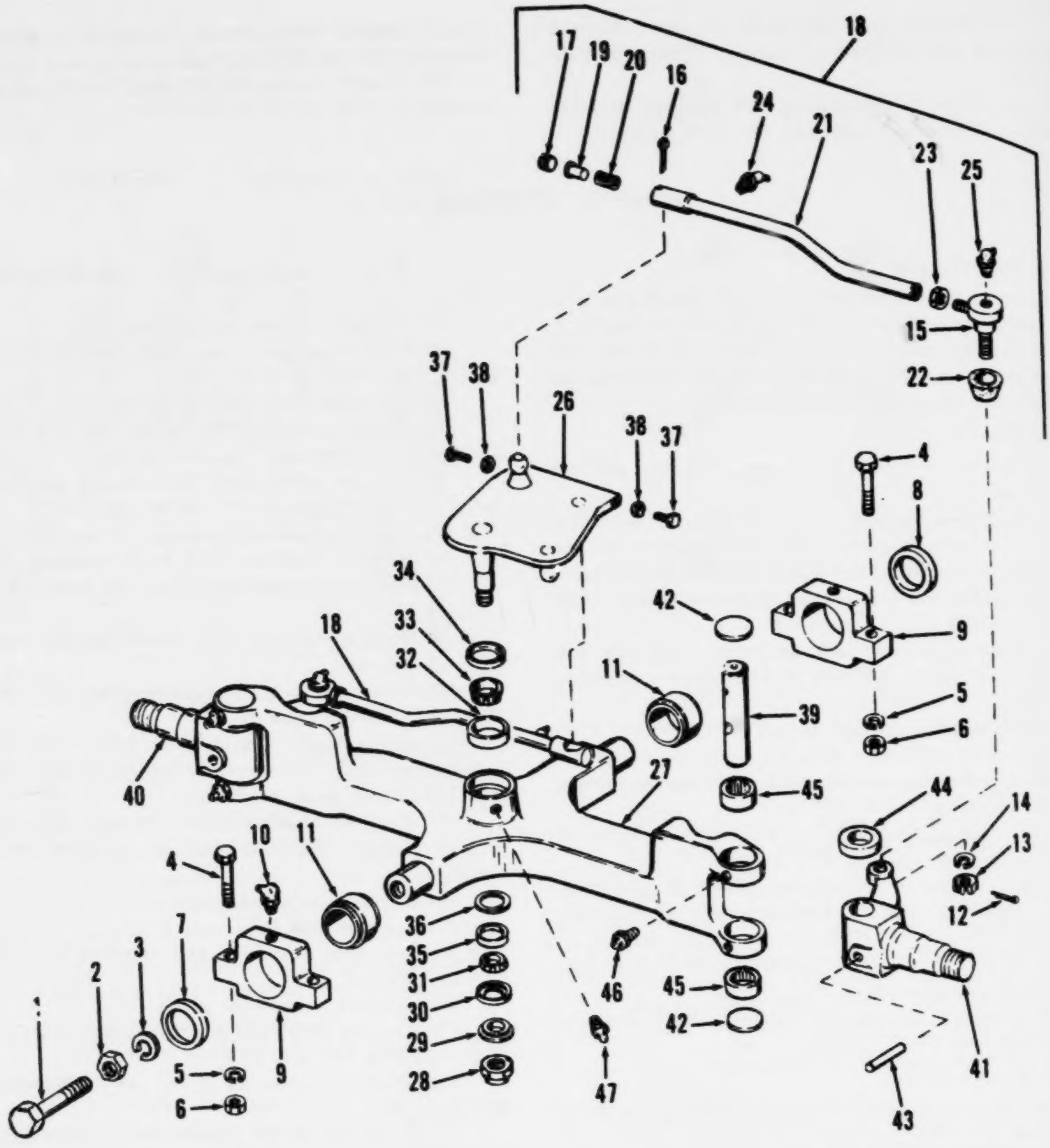
(1) Remove expansion plugs (42).

(2) Remove pins (43) and tap king pins (39) from spindles (40 and 41).

(3) Remove spindles from axle. Remove bearings (44).

(4) Press out needle bearings (45) from axle.

(5) Remove lubrication fittings (46 and 47).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ME 3930-628-34/5-10

1. Adjusting screw
2. Lock nut
3. Lock washer
4. Screw
5. Lock washer
6. Nut
7. Front spacer
8. Rear spacer
9. Bearing housing
10. Lubrication fitting
11. Sleeve bearing
12. Cotter pin
13. Nut
14. Washer
15. Rod end
16. Cotter pin
17. Adjusting plug
18. Tie rod assembly
19. Ball seat
20. Spring
21. Tie rod
22. Cover
23. Jam nut
24. Lubrication fitting
25. Lubrication fitting
26. Pivot arm
27. Steering axle
28. Nut
29. Washer
30. Grease seal
31. Bearing cone
32. Bearing cup
33. Bearing cone
34. Grease seal
35. Bearing cup
36. Retaining ring
37. Adjusting screw
38. Lock nut
39. King pin
40. Spindle, R. H.
41. Spindle, L. H.
42. Expansion plug
43. Pin
44. Bearing
45. Needle bearing
46. Lubrication fitting
47. Lubrication fitting

Figure 5-10. Steering axle, exploded view.

5-8. Cleaning, Inspection and Repair

a. Clean all parts with cleaning compound, solvent (Fed. Spec. P-D-680).

b. Inspect all moving parts, bearings, and attaching parts for wear, corrosion or other damage.

c. Worn or deteriorated parts must be replaced as authorized.

5-9. Installation

a. Refer to figure 5-10 and assemble and install the steering axle as follows:

b. Install king pins (39) and spindles (40 and 41) as follows:

(1) Install needle bearings (45) in axle. Align hole in needle bearings with lubrication hole in axle. Install lubrication fittings (46).

(2) Align spindles (40 and 41) and bearings (44) in axle and tap in king pins (39).

(3) Align king pins (39) in spindle (40 and 41) and tap in spring pins (43) to secure king pin.

(4) Install expansion plugs (42).

(5) Lubricate assembly (LO 10-3930-628-12).

c. Install pivot arm (26) in axle (27) as follows:

(1) Install lubrication fitting (47) and pack bearing cones (31 and 33) with grease (GAA).

(2) Install retaining ring (36) and bearing cups (32 and 35) in axle (27), if they are removed.

(3) Install seal (34) and press bearing cone (33) on pivot arm (26).

(4) Install pivot arm (26) in axle (27), firmly seating bearing cone (33) in bearing cup (32).

(5) Press bearing cone (31) into bearing cup (35) at bottom of axle.

(6) Install new seal (30) and slide washer (29) on pivot arm (26). Secure assembly with nut (28). Preload bearings as follows:

(a) Use torque wrench to tighten nut (28) and note torque reading while advancing cone toward seated position. Torque will increase noticeably when bearing cone starts to seat. Continue tightening nut until torque reading is 15-25 foot-pounds greater than before noticeable increase.

(b) Check rotational bearing torque by rotating pivot arm (26) back and forth several times. Rolling torque reading must be 15-25 inch-pounds.

(c) If rolling torque is below 15 inch-pounds, tighten nut (28) an additional 5 foot-pounds and repeat rolling torque test. Repeat procedure until rolling torque is within specifications.

(d) If rolling torque exceeds 25 inch-pounds, back off nut (28) one full turn. Stroke pivot shaft end with soft mallet to unseat bearings and repeat procedure above until rolling torque reading is correct. This procedure applies to both new and reused bearings.

(e) Stake nut (28) to hold position.

(7) Using fitting (47), lubricate cavity with grease (LO 10-3930-628-12).

d. Install lubrication fittings (10), bearings (11), and spacer (8) in housings (9). Install assembled housings on axle.

e. Lubricate housing (9) per LO 10-3930-628-12.

f. Assemble and install tie rods (18, fig. 5-10) as follows:

(1) Install lubrication fittings (24 and 25) on rods (21) and tie rod ends (15).

(2) Install tie rod ends (15) in rods (21) and tighten jam nuts (23).

(3) Install covers (22) on tie rod ends (15).

(4) Install adjusting springs (20), ball seats (19) and plugs (17) in tie rods (21).

(5) Install tie rods on spindles (40 and 41) and pivot arm (26).

(6) Adjust plug (17) by tightening until all end play is just removed. Continue tightening plug about one more turn to align cotter pin holes and compress spring. Secure plug with cotter pin (16).

(7) Secure tie rod ends (15) to axle with flat washers (14, nuts (13), and cotter pins (12).

(8) Lubricate tie rod ends (15) and rods (21) (LO 10-3930-628-12).

5-10. Installation

a. Install axle assembly in place and secure bearing housings (9, fig. 5-10) to trunnion blocks with screws (4), lock washers (5), and nuts (6). Leave nuts (6) loose.

b. Push entire axle assembly against rear spacer (8). Install spacer (7) in housing. Install adjusting screw (1) and lock nut (2) with screw through frame and against spacer (7). Bearings and spacers must be concentrically seated along axis. Tighten adjusting screw (1) to 10-15 foot pounds. Hold adjusting screw (1) and tighten lock nut (2) to 90-100 foot pounds. Tighten nuts (6) to 90-100 foot-pounds.

c. Refer to TM 10-3930-628-12 and connect steering drag link to steering axle.

d. Refer to TM 10-3930-628-12 and install wheels on axle.

5-11. Adjustment

a. Refer to TM 10-3930-628-12 for adjustment procedures.

b. After adjustment, remove blocks and lower truck to ground.

CHAPTER 6

BRAKE, WHEEL, AND TIRE REPAIR INSTRUCTIONS

Section I. SERVICE BRAKE

6-1. Description

The hydraulic brake system is of the full floating, self-centering, self-adjusting type which consists of a mechanically actuated master cylinder transmitting hydraulic pressure through heavy duty brake lines to wheel cylinders. The wheel cylinders are of the double-ended type, with actuating links extending from each end of the cylinders. The links transmit movement from the cylinders to the brake shoes. The top of each shoe moves freely in a wear plate, while the bottom of the shoe transfers movement from the hydraulic wheel cylinders. Wear adjustment for brake linings is made automatically in normal use by the self-adjusting mechanism. The shoes are held against the brake wear plates, wheel cylinder links, and adjusting eccentrics by tension springs, which maintain the shoes in equilibrium.

6-2. Brake Shoes

a. Removal. Refer to TM 10-3930-628-12 for removal procedures.

b. Repair.

(1) Minor charring, dirt, or grease on brake linings (not grease soaked) should be remedied by buffing with sand paper or grinding.

(2) Clean shoes with compressed air and dry cloth to prevent damaging shoes or linings.

Caution: **Whenever handling brake shoes, be careful not to get grease or dirt on brake linings as serious damage will result.**

c. Replacement. Brake shoes employ bonded lining. When replacement becomes necessary, a similar type of lining must be installed. Replace shoes (TM 10-3930-628-12) when the following have occurred:

(1) Drums are resurfaced.

(2) Lining is worn to shoe table or within 1/16 inch thickness.

(3) Grease or hydraulic fluid has soaked linings, causing brakes to grab or pull to one side.

(4) Charred or burned linings.

(5) Lining scored deeply.

(6) Brake shoe table worn, twisted or out-of-ound.

(7) Shoe is cracked.

d. Installation. Refer to TM 10-3930-628-12 or installation procedures.

6-3. Brake Drum

a. Removal and Cleaning. Refer to TM 10-3930-628-12 for removal and cleaning procedures.

b. Inspection and Repair.

(1) Check inside diameter of brake drum at 45 degree intervals, around circumference, using a micrometer or diameter bar and thickness gages. If diameter measurements difference exceeds 0.010 inch or radius difference exceeds 0.005 inch, resurface drum.

(2) Examine drum for scoring or heat checking. Resurface drum if score marks can be felt or any heat checking can be seen. Heat check cracks form cutting edges, which quickly shave off lining surfaces.

(3) Check drums for "bell mounted" or "barrel shaped" wear by placing drum on drum lathe and advancing tool until it contacts drum at its high points. Then advance tool to contact low points. Measure the difference and resurface the drum, if difference exceeds 0.005 inch (radius).

(4) If drum requires resurfacing, proceed as follows:

(a) Resurface in pairs.

(b) Machine to same diameter. Do not exceed 11.0 + 0.010 inch diameter. Replace wheel if diameter exceeds this dimension.

(c) Finish grind or hone to remove tool marks from drum. Marks will cause rapid wear of lining if roughness remains.

(5) If drum does not require resurfacing, polish with fine emery cloth to remove discolorations or old lining residue.

c. Installation. Refer to TM 10-3930-628-12 for installation procedures.

6-4. Wheel Cylinder

a. Description. The hydraulic wheel cylinder houses two opposed pistons, which actuate two opposed brake shoes. Pistons, rubber cups, and springs are held in the cylinder by pressure from the brake shoes. Open ends of the cylinder are protected by rubber boots.

b. Removal. Refer to TM 10-3930-628-12 for removal procedures.

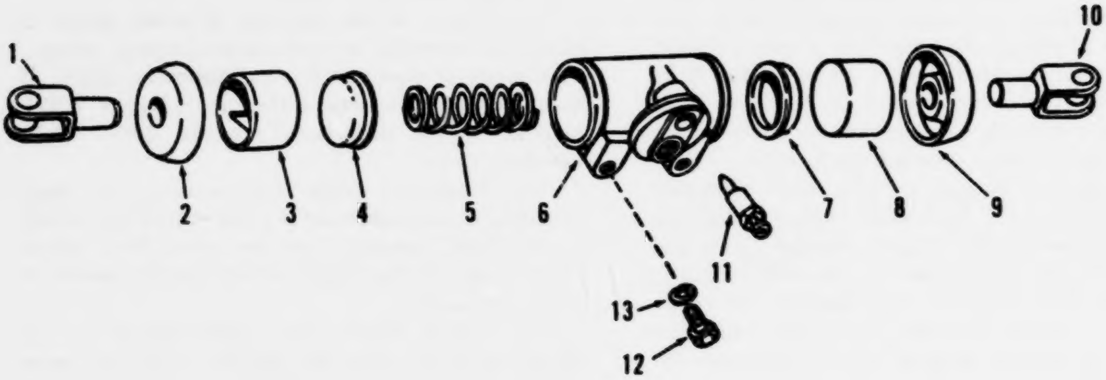
c. Disassembly.

(1) Refer to figure 6-1 and disassemble as follows:

(2) Remove rubber boots (2 and 9) and connecting links (1 and 10) from cylinder ends.

(3) Push out pistons (3 and 8), piston cups (4 and 7), and spring (5) from cylinder body (6). Low pressure air at fluid inlet can also be used to remove internal parts.

(4) Remove bleeder (11).



ME 3930-628-34/6-1

1. Connecting link
2. Boot
3. Piston
4. Piston cup
5. Spring
6. Cylinder body
7. Piston cup
8. Piston
9. Boot
10. Connecting link
11. Bleeder
12. Screw
13. Lock washer

Figure 6-1. Brake wheel cylinder, exploded view.

d. Cleaning and Inspection.

(1) Clean all parts thoroughly and keep them clean until unit is ready for assembly. Use lint free cloth for cleaning.

Caution: Wash parts thoroughly in denatured alcohol or clean brake fluid. Never use gasoline, kerosene, paint thinner or other mineral base solvents as they will damage rubber components.

(2) Thoroughly inspect all parts for wear, corrosion or other conditions which might impair cylinder action.

Caution: Do not use emery cloth or sandpaper.

(3) Inspect cylinder bore. Deep blemishes require boring to resurface the cylinder wall. Do not bore beyond manufacturer's specifications. Pressure marks may be polished out with crocus cloth.

(4) If it is necessary to resurface the cylinder wall, use the following procedure:

(a) Coat walls of cylinder bore with hydraulic brake fluid.

(b) Secure cylinder body in a bench vise.

(c) Using honing equipment, remove material from cylinder bore in single passes.

(d) After each pass is completed, remove hone and inspect for scratches and pitting. Remove only enough material to recondition cylinder bore. Do not hone cylinder oversize.

Note. If the cylinder has been honed oversize or greater than 1.507 of an inch, it must be replaced.

(e) Wash master cylinder body in a clean warm water and soap solution.

(f) Final rinse cylinder in clean warm water and blow dry with compressed air. Immediately submerge cylinder body in clean hydraulic brake fluid.

(5) Before assembly, inspect parts for corrosion, scratched or pitted piston bearing surfaces, rubber deterioration, and defective spring action.

(6) Replace worn, damaged, corroded or deteriorated parts as authorized.

e. Assembly.

(1) Refer to figure 6-1 and assemble as follows:

(2) Lubricate all parts and cylinder walls with clean brake fluid.

(3) Insert spring (5) and piston cups (4 and 7) in cylinder body.

(4) Insert each piston (3 and 8) in its respective end. Never attempt to push piston through length of cylinder.

(5) Install boots (2 and 9), being sure they are properly located in grooves provided.

f. Installation. Refer to TM 10-3930-628-12 for installation procedures.

6-5. Master Cylinder

a. Description. The brake master cylinder and fluid reservoir are combined in one casting, and are joined by intake and by-pass ports in the cylinder wall. Internal parts are removable through the push rod end.

b. Removal. Refer to TM 10-3930-628-12 for removal procedures.

c. Disassembly.

(1) Refer to figure 6-2 and disassemble as follows:

(2) Secure cylinder in vise, using care not to distort or crack casting.

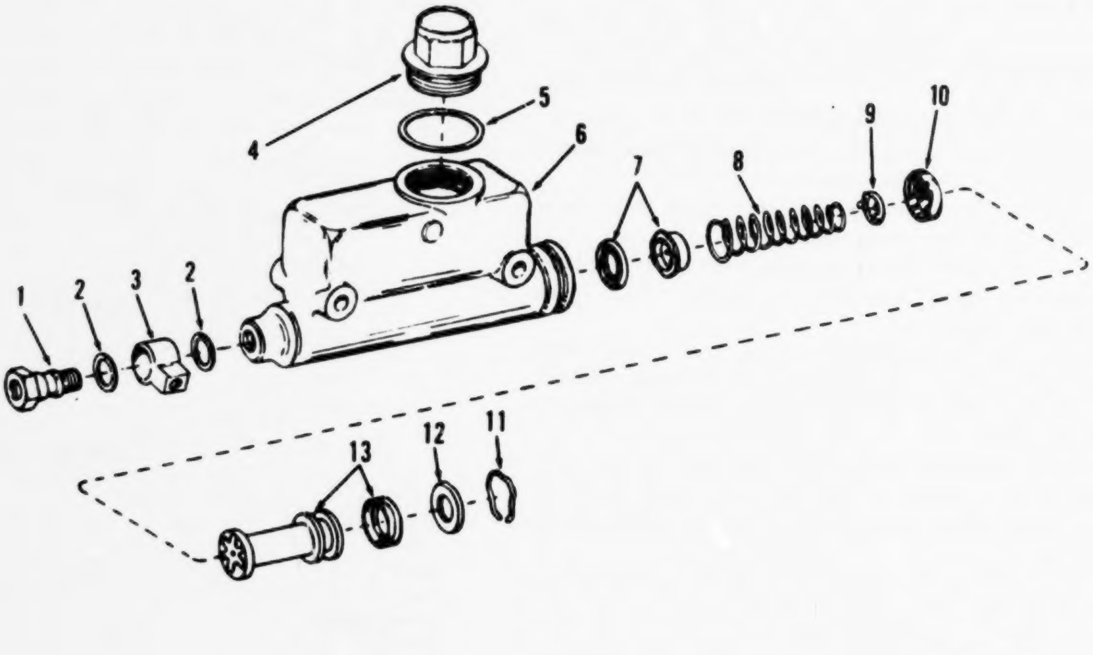
(3) Holding piston assembly (13) in cylinder, gently pry off lockwire (11).

Caution: **When lockwire is removed, continue holding piston in place or entire assembly will spring out.**

(4) Slowly relax hold on piston and carefully remove stop plate (12), piston assembly (13), rubber piston cup (10), retainer (9), spring (8), and check valve (7).

(5) Remove bolt (1), gaskets (2), and fitting (3).

(6) Remove filler plug (4) and gasket (5).



ME 3930-628-34/6-2

1. Outlet bolt
2. Gasket
3. Fitting
4. Plug
5. Gasket
6. Cylinder and tank
7. Check valve
8. Spring
9. Retainer
10. Piston cup
11. Lockwire
12. Stop plate
13. Piston assembly

Figure 6-2. Master brake cylinder, exploded view.

d. Cleaning and Inspection.

Caution: **Dirty parts or internal rubber parts which become swollen, tacky, and otherwise deteriorated by mineral base cleaning solvents can lead to brake failure and possible injury to the operator.**

(1) Clean all parts with denatured alcohol or brake fluid, and keep clean in all following operations.

Caution: Do not use emery cloth or sandpaper.

(2) Inspect cylinder bore. Deep blemishes require boring to resurface the cylinder wall. Do not bore beyond manufacturer's specifications. Pressure marks may be polished out with crocus cloth.

(3) Make sure intake and by-pass ports are open. By-pass ports may be probed with soft iron wire.

(4) If it is necessary to resurface the cylinder wall, use the following procedure:

(a) Coat walls of cylinder bore with hydraulic brake fluid.

(b) Secure master cylinder body in a bench vise.

(c) Using honing equipment, remove material from cylinder bore in single passes.

(d) After each pass is completed, remove hone and inspect for scratches and pitting. Remove only enough material to recondition cylinder bore. Do not hone cylinder oversize.

Note. If the master cylinder has been honed oversize or greater than 1.007 of an inch, it must be replaced.

(e) Wash master cylinder body in a clean warm water and soap solution.

(f) Check to be certain intake and by-pass ports are open and free of burrs, which may damage piston cups.

(g) Final rinse cylinder in clean warm water and blow dry with compressed air. Immediately submerge master cylinder body in clean hydraulic brake fluid.

(5) Before assembly, inspect parts for corrosion, scratched or pitted piston bearing surfaces, rubber deterioration, and defective spring action.

(6) Replace worn, damaged, corroded or deteriorated parts as authorized.

(7) Replace all gaskets.

e. Assembly. Refer to figure 6-2 and assemble as follows:

(1) Lubricate parts and cylinder bore with clean brake fluid.

(2) Using new gasket (5) install plug (4) and gasket.

(3) Install fitting (3) and bolt (1) with new gaskets (2).

(4) Install check valve (7) and spring (8) with largest ends toward outlet end of cylinder. Hold in place.

(5) While holding spring in place, insert retainer (9), piston cup (10), piston assembly (13), and stop plate (12).

(6) Firmly seat lockwire (11) in groove.

f. Installation. Refer to TM 10-3930-628-12 for installation procedure.

6-6. Brake Pedal

a. Removal.

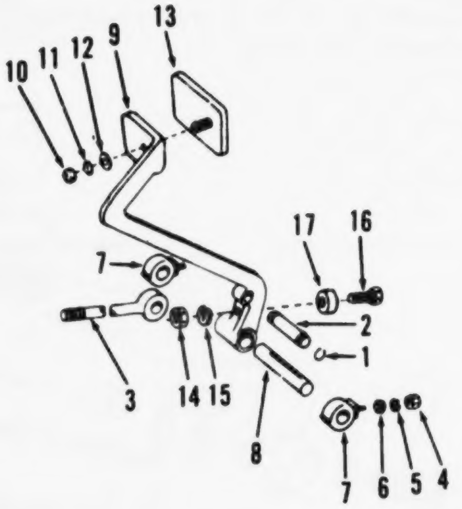
(1) Remove floor plates and toe plate (TM 10-3930-628-12).

(2) Remove retaining rings (1, fig. 6-3).

(3) Remove shaft (2) to free pedal (9) from master cylinder rod (3).

(4) Remove nuts (4), lock washers (5) and washers (6). Remove pillow block bearings (7) from pivot pin (8).

(5) Drive pivot pin (8) from pedal (9).



ME 3930-628-34/6-3

1. Retaining ring
2. Shaft
3. Rod
4. Nut
5. Lock washer
6. Washer
7. Bearings
8. Pivot pin
9. Brake pedal
10. Nut
11. Lock washer
12. Washer
13. Pad
14. Nut
15. Lock washer
16. Screw
17. Bumper

Figure 6-3. Brake pedal assembly and related parts, exploded view.

b. Disassembly. Refer to figure 6-3 and disassemble pedal as follows:

(1) Remove nut (10), lock washer (11), washer (12) and pad (13).

(2) Remove nut (14), lock washer (15), screw (16) and bumper (17) only if replacement is necessary.

c. Inspection. Inspect all parts for damage and wear. Replace defective parts as authorized.

d. Assembly. Refer to figure 6-3 and assemble brake pedal in reverse order of disassembly.

e. Installation. Refer to figure 6-3 and install brake pedal as follows:

(1) Install pivot pin (8) in pedal (9).

(2) Install bearings (7) on pin (8).

(3) Install assembly in truck with nuts (4), lock washers (5) and washers (6).

(4) Align cylinder rod (3) with pedal hole and install shaft (2).

(5) Install retaining rings (1).

f. Adjustment and Lubrication. Refer to TM 10-3930-628-12 and LO 10-3930-628-12 for adjustment and lubrication procedures.

Section II. PARKING BRAKE ASSEMBLY

6-7. Description

The parking brake is a two-shoe mechanical brake mounted on the drive motor armature shaft. Braking action is initiated through spring pressure and a mechanical linkage attached to the brake actuating lever. Pressure rotates a lever inside the brake drum forcing the spring retained shoes outward, causing the shoe linings to contact the rotating drum. When brake drum movement is stopped the truck can not be moved until the parking brake is released. When spring pressure is relieved the brake shoes are returned to neutral position by shoe return springs.

6-8. Removal and Disassembly

a. Raise front end of lift truck for access to parking brake. Block frame and rear wheel securely.

b. Raise operator's seat until seat hinge is secured in seat latch.

c. Disconnect upper actuating link yoke from seat actuating arm. Refer to TM 10-3930-628-12 and remove lower spring and linkage.

d. Refer to paragraph 2-6 to disconnect drive motor from drive axle. Lower motor far enough to allow room to remove parking brake.

e. Refer to figure 6-4. Remove nut holding drum (1) to motor shaft.

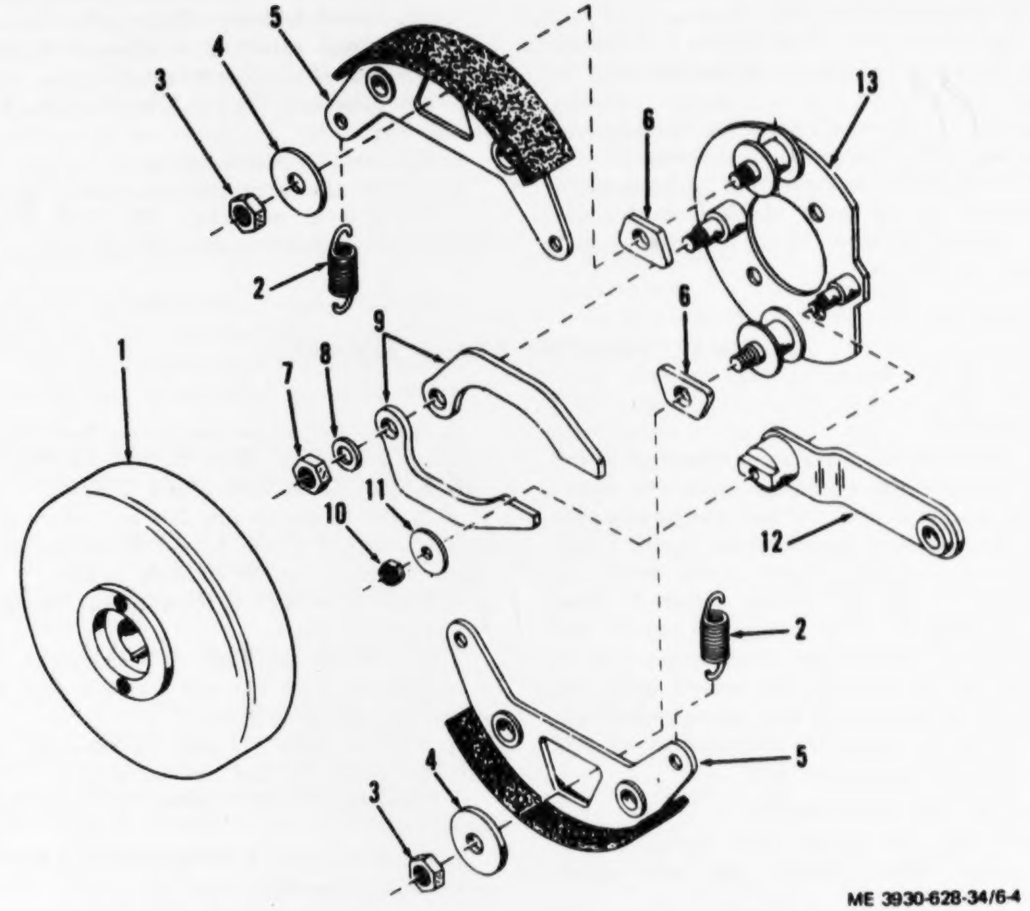
f. Disconnect and remove springs (2).

g. Remove nuts (3) and washers (4). Remove shoes (5) and inserts (6).

h. Remove nuts (7) and washers (8) securing actuator arms (9) and remove arms.

i. Remove nut (10), washer (11) and actuating lever (12).

j. Remove screws holding backing plate (13) to drive motor housing.



1. Drum
2. Return spring
3. Nut
4. Washer
5. Brake shoes
6. Insert
7. Nut
8. Washer
9. Actuating arm
10. Nut
11. Washer
12. Actuating lever
13. Backing plate

Figure 6-4. Parking brake assembly, exploded view.

6-9. Inspection

a. Refer to figure 6-4 and inspect as follows:

b. Check backing plate (13) for distortion, worn pivot bushings and loose pivot mountings.

c. Check brake shoes (5) for wear or grease saturation. Replace brake shoes if lining is worn to 1 / 16 inch thickness.

d. Check brake shoes (5) and inserts (6) for worn pivot holes and actuating arm contact areas.

e. Check brake drum (1) for cracks, scoring or other damage.

f. Inspect actuating arms (9) and lever (12) for excessive wear.

g. Always replace springs (2) in pairs.

6-10. Assembly and Installation

a. Refer to figure 6-4 and assemble as follows:

b. Lightly coat backing plate (13) pivots and bushings with brake lubricant. Avoid excessive use as grease-soaked linings are dangerous.

c. Assemble the parking brake in reverse order of disassembly.

d. Refer to paragraph 2-6 and connect drive motor to drive axle. Refer to TM 10-3930-628-12 to install lower spring and connect linkage.

e. Remove blocks and lower truck wheels to floor.

f. Adjust parking brake linkage (TM 10-3930-628-12).

Section III. WHEEL AND TIRE ASSEMBLIES

6-11. Description

Drive wheel assemblies consist of a wheel, which serves as a brake drum, a bull gear, a tire, and inner and outer tapered roller bearings. Rear wheel assemblies contain a wheel, a tire, and inner and outer tapered roller bearings. Each wheel assembly is secured to its respective axle by a nut and cotter pin located under a hub cap.

6-12. Removal

Refer to TM 10-3930-628-12 for removal procedures of either steering or drive wheel assemblies.

6-13. Disassembly

a. *Drive Wheel Assembly.* Refer to figure 6-5 and disassemble as follows:

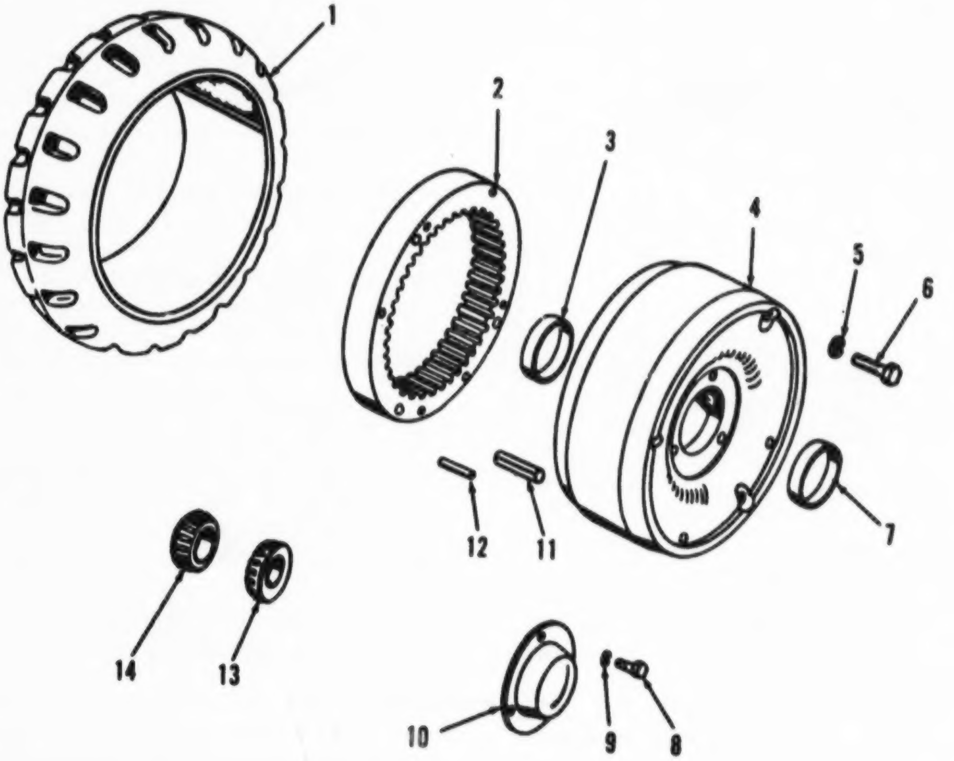
(1) If inspection indicates replacement is necessary, remove tire (1) from wheel (4) (para 6-17).

(2) Remove screws (6), lock washers (5), and bull gear (2) from wheel (4).

(3) Turn wheel (4) over, and drive bull gear (2) from wheel using same screws (6). Tighten screws evenly.

(4) Remove pins (11 and 12) from bull gear (2).

(5) Using bearing cup puller, remove bearing cups (3 and 7) from wheel (4).



ME 3930-628-34/6-5

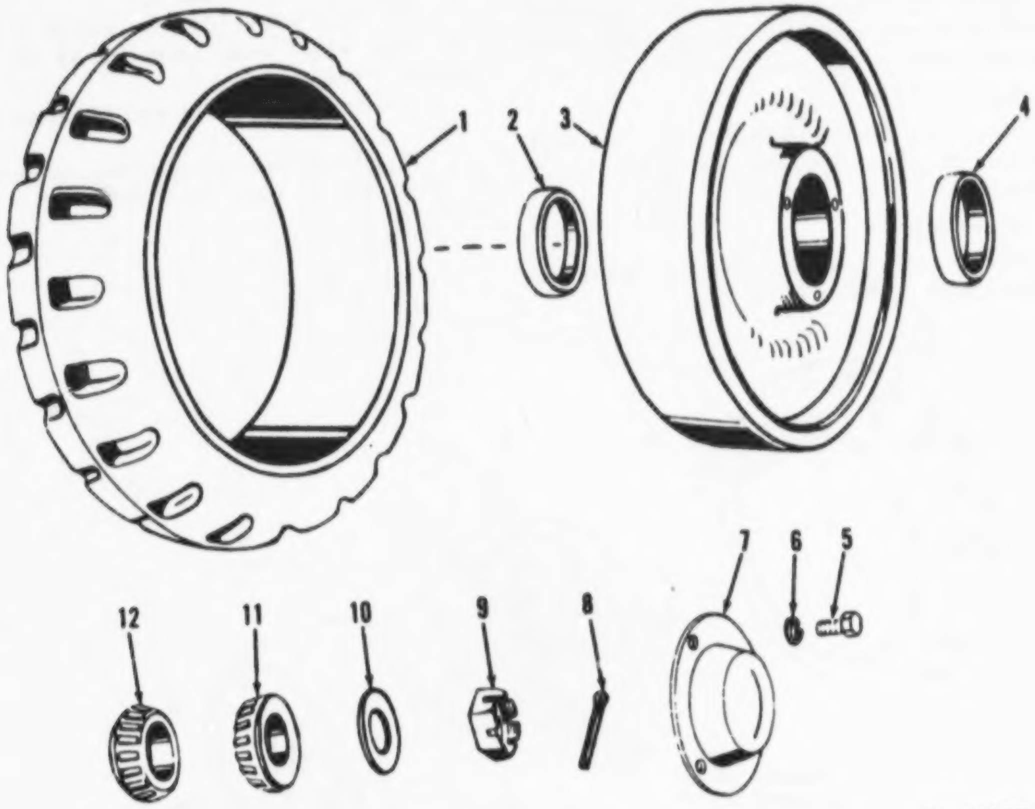
1. Tire
2. Bull gear
3. Inner bearing cup
4. Drive wheel
5. Lock washer
6. Screw
7. Outer bearing cup
8. Screw
9. Lock washer
10. Hub cap
11. Spring pin
12. Pin
13. Outer bearing cone
14. Inner bearing cone

Figure 6-5. Drive wheel assembly, exploded view.

b. Rear Wheel Assembly. Refer to figure 6-6 and disassemble as follows:

(1) If inspection indicates replacement is necessary, remove tire (1) from wheel (3) (para 6-17).

(2) Using bearing cup puller, remove bearing cups (2 and 4) from wheel (3).



ME 3930-628-34/6-6

1. Tire
2. Inner bearing cup
3. Wheel
4. Outer bearing cup
5. Bolt
6. Lock washer
7. Hub cap
8. Cotter pin
9. Nut
10. Flat washer
11. Outer bearing cone
12. Inner bearing cone

Figure 6-6. Rear wheel assembly, exploded view.

6-14. Cleaning, Inspection, and Replacement

a. Inspect tire for wear (TM 10-3930-628-12) and replace if necessary (para 6-17).

b. Clean all parts with cleaning compound, solvent (Fed. Spec. P-D-680). Dry thoroughly with compressed air.

c. Inspect bearing cones and cups, wheels, and bull gear for damage and excessive or uneven wear.

d. Replace all parts as authorized.

e. Repack bearings (TM 10-3930-628-12).

6-15. Assembly

a. Drive Wheel Assembly. Refer to figure 6-5 and assemble as follows:

(1) Press bearing cups (3 and 7) in wheel hub with taper to outside of wheel. Tap in place evenly around edge of cup.

Caution: Pressure must be evenly distributed on cups to avoid damage and cocking.

(2) Install pins (11 and 12) in bull gear (2).

(3) Align pins and install bull gear (2) on wheel (4), using screws (6) from other side of wheel. Tighten screws evenly and in sequence.

(4) Remove screws (6) and secure bull gear (2) to wheel (4) with screws (6) and lock washers (5) as originally installed. Torque screws to 28 to 32 foot pounds.

(5) Lubricate bull gear (LO 10-3930-628-12).

(6) Mount new tire (1) on wheel (4) (para 6-17), if replacement is necessary.

b. Rear Wheel Assembly. Refer to figure 6-6 and assemble as follows:

(1) Press bearing cups (2 and 4) in wheel hub.

Caution: Pressure must be evenly distributed on cups to avoid damage and cocking.

(2) Mount new tire (1) on wheel (3) (para 6-17), if replacement is necessary.

6-16. Installation

Refer to TM 10-3930-628-12 for installation procedures of either rear or drive wheel assemblies.

Note. Wheels must rotate freely, with no bearing end-play.

6-17. Tire Replacement

Refer to figure 6-7 and the following procedure for the removal:

a. Remove wheel and tire assembly (TM 10-3930-628-12).

b. Check inside diameter of new tire. Remove any signs of scale or rust with sandpaper. Lubricate inside of new tire with bearing grease (GAA).

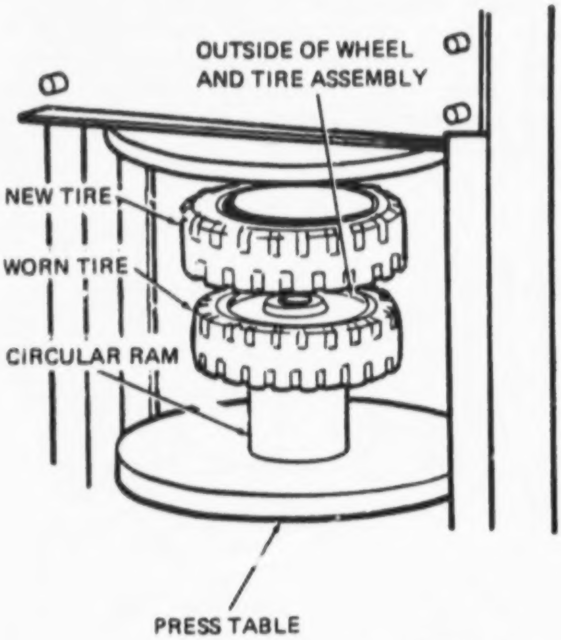
c. Place a circular ram on the press table. The length of the ram must be greater than the width of the tire to allow complete removal of the old tire. The outside diameter of the ram must be large enough to rest squarely on the bull gear's flat surface (drive wheels) or on the flat surface provided around the wheel hub (steer wheels).

d. If the outside edge of the wheel is not flush with the edge of the metal insert in the old tire, measure how far wheel is recessed inside the tire. New tires must be installed in the same position as the worn tire. A spacer, slightly smaller in diameter than the inside diameter of the tire and the same thickness as the depth of the recess, can be used to obtain the proper amount of recess.

e. Center worn tire and wheel assembly over ram. Be sure ram and wheel match squarely.

f. Position new tire on top of wheel and old tire assembly. Align new tire and the wheel and old tire assembly so that they are concentric with each other (fig. 6-7).

Note. Make certain the outside of the wheel is positioned upwards, because the outside edge of the wheel has a slight chamfer to help guide the wheel into the new tire. The tire can only be installed in one direction to prevent damage to the wheel.



ME 3930-628-34/6-7

Figure 6-7. Tire positioning for replacement.

g. Start pressing new tire on the wheel and worn tire off the wheel. Run press slowly for the first inches of travel. If tire begins to cock, stop press and align wheel and tires. A sharp jar with a mallet will normally align wheel and tire. If the wheel is to be recessed in the tire, stop the press after the wheel has started into the new tire and position a spacer on the inside diameter of the new tire. The spacer on the outer edge of the wheel. Continue pressing the new tire on wheel until tire is correctly positioned.

Note. When pressing tires on wheels, the tire on the rear wheel must overlap wheel ½ inch on inside of wheel. Drive wheel tire must overlap wheel ¼ inch on inside of wheel.

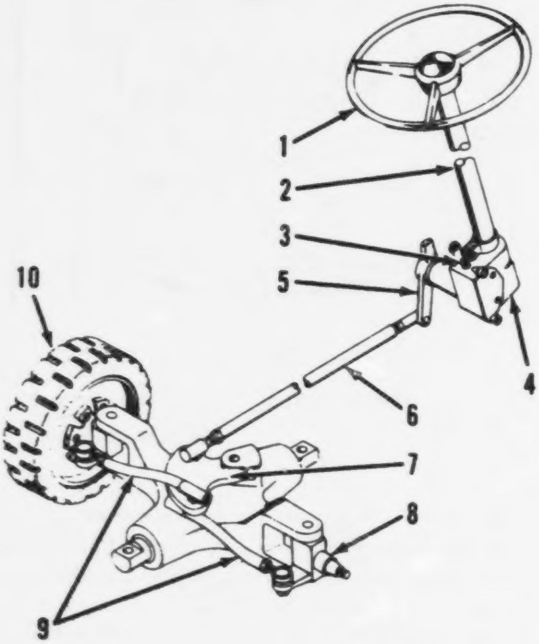
h. Release press and remove tires. Inspect new wheel and tire assembly.

i. Install new wheel and tire assembly (TM 10-3930-628-12).

Section IV. STEERING GEAR ASSEMBLY

6-18. Description

The steering system consists of a steering gear assembly, drag link assembly and steering axle (fig. 6-8). Major components of the steering gear assembly are a wheel, steering gear unit and steering arm. When the wheel is turned, the steering gear worm arrangement swings the steering arm, exerting force on the drag link to pivot the steering wheels.



ME 3930-628-34/6-8

1. Steering wheel
2. Steering column
3. Filler plug
4. Steering gear assembly
5. Steering arm
6. Drag link
7. Pivot arm
8. Wheel spindle
9. Tie rods
10. Rear wheel

Figure 6-8. Steering system.

6-19. Removal

a. Remove floor and toe plates (TM 10-3930-628-12).

b. Remove steering wheel (TM 10-3930-628-12).

c. Loosen adjusting plug in drag link and disconnect drag link (6) from steering arm (5).

d. Remove ties holding electrical cables to steering column. Push cables aside.

e. Disconnect and remove horn button wires.

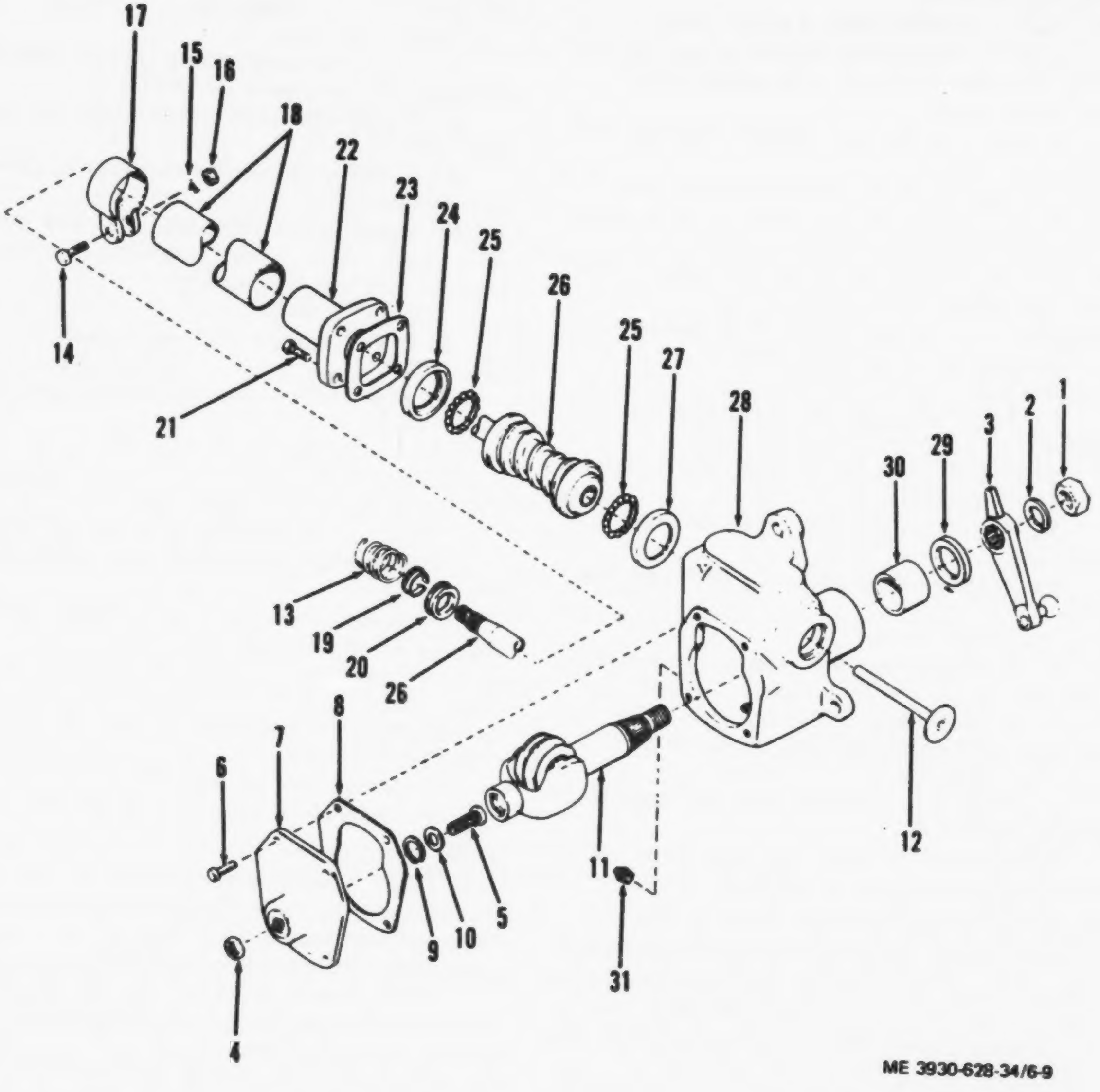
f. Loosen screws (6, fig. 6-9) and allow oil to drain from housing.

g. Remove clamp bracket at upper part of column.

h. Remove nut (1, fig. 6-9), lock washer (2) and steering arm (3) from steering gear.

i. Remove screws, nuts and lock washers attaching steering gear assembly (4, fig. 6-8) to frame bracket.

j. Lift steering gear assembly up and out of truck and place in clean work area for disassembly.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ME 3930-628-34/6-9

1. Nut
2. Lock washer
3. Steering arm
4. Nut
5. Adjusting screw
6. Screw
7. Cover
8. Gasket
9. Retaining ring
10. Thrust washer
11. Shaft
12. Grease tube
13. Spring
14. Screw
15. Lock washer
16. Nut
17. Clamp
18. Tube
19. Spacer
20. Bearing
21. Screw
22. Cap
23. Shims
24. Upper bearing cup
25. Bearings
26. Shaft and worm
27. Lower bearing cup
28. Gear housing
29. Oil seal
30. Sleeve bearing
31. Filler plug

Figure 6-9. Steering gear assembly, exploded view.

6-20. Disassembly

a. General. Refer to figure 6-9 when disassembling. Disassembly should proceed only as far as necessary for repair and replacement.

b. Roller Shaft.

(1) Place steering gear assembly in a vise with column up.

(2) Remove nut (4) from adjusting screw (5).

(3) Remove screws (6), cover (7) and gasket (8).

(4) Remove retaining ring (9), thrust washer (10) and adjusting screw (5) from shaft (11). Carefully withdraw shaft (11) from housing.

(5) Remove grease tube (12).

c. Steering Column.

(1) Remove spring (13) from upper end of column.

(2) Loosen clamp screw (14) and pull tube (18) from cap (22).

(3) Remove spacer (19) and bearing (20) from tube (18).

(4) Remove screws (21), cap (22) and shims (23).

d. Shaft and Worm.

(1) Carefully tap shaft and worm assembly from gear housing with bearings attached.

(2) Remove upper bearing cup (24) and bearings (25) from shaft and worm (26).

e. Gear Housing.

(1) Press lower bearing cup (27) from gear housing (28).

(2) Remove oil seal (29) and press sleeve bearing (30) from gear housing.

(3) Remove filler plug (31).

6-21. Cleaning, Inspection and Replacement

a. Clean all parts with cleaning compound, solvent (Fed. Spec. P-D-680). Cleaning may be done during disassembly and parts set to dry on clean paper towel.

b. Inspect all moving parts to make sure they have not been scored or damaged by dirt particles. Smooth burnished surfaces are normal in some areas. Any slightly scored parts may be cleaned by hand rubbing with 600 grit abrasive paper.

c. Prepare all parts for reassembly as follows:

(1) Coat metal parts with engine oil (OE).

(2) Coat ball bearings with grease (GAA).

6-22. Assembly

a. General. Refer to figure 6-9 when assembling.

b. Gear Housing.

(1) Wipe sleeve bearing bore clean of dirt particles and press in bearing sleeve (30).

(2) Wipe lower steering column shaft bearing cup seat clean of dirt particles and press in bearing cup (27).

c. Shaft and Worm.

(1) Hold lower ball bearing (25) in lower cup (27) with coat of grease (GAA).

(2) Install upper ball bearing (25) on worm shaft (26).

(3) Install upper bearing cup (24) and install shaft in housing.

(4) Install shims (23), cap (22) and screws (21). Turn shaft while tightening screws to properly seat ball bearings.

d. Steering Column.

(1) Install bearing (20) and spacer (19) in tube (18).

(2) Install tube on cap (22) and tighten clamp screw (14).

(3) Install spring (13).

e. Roller Shaft.

(1) Install grease tube (12).

(2) Install adjusting screw (5) in end of shaft (11). Install thrust washer (10) and retaining ring (9).

(3) Install shaft (11) in housing, carefully aligning worm and roller.

(4) Install new gasket (8), cover (7) and screws (6).

(5) Install adjusting screw nut (4).

f. Gear Housing.

(1) Install new oil seal (29).

(2) Install filler plug (31) in housing (28).

6-23. Installation

a. Install steering gear assembly in the truck. Attach gear housing to frame bracket with screws, nuts and lock washers.

b. Install steering arm as follows:

(1) The index mark on the hub of steering arm (fig. 6-10) must match the missing tooth space on the gear unit shaft.

(2) Install lock washer (2, fig. 6-9) and nut (1). Tighten nut to 140—170 foot pounds torque.

(3) Install upper column clamp bracket.

(4) Connect horn button wires.

(5) Attach electrical cables to column.

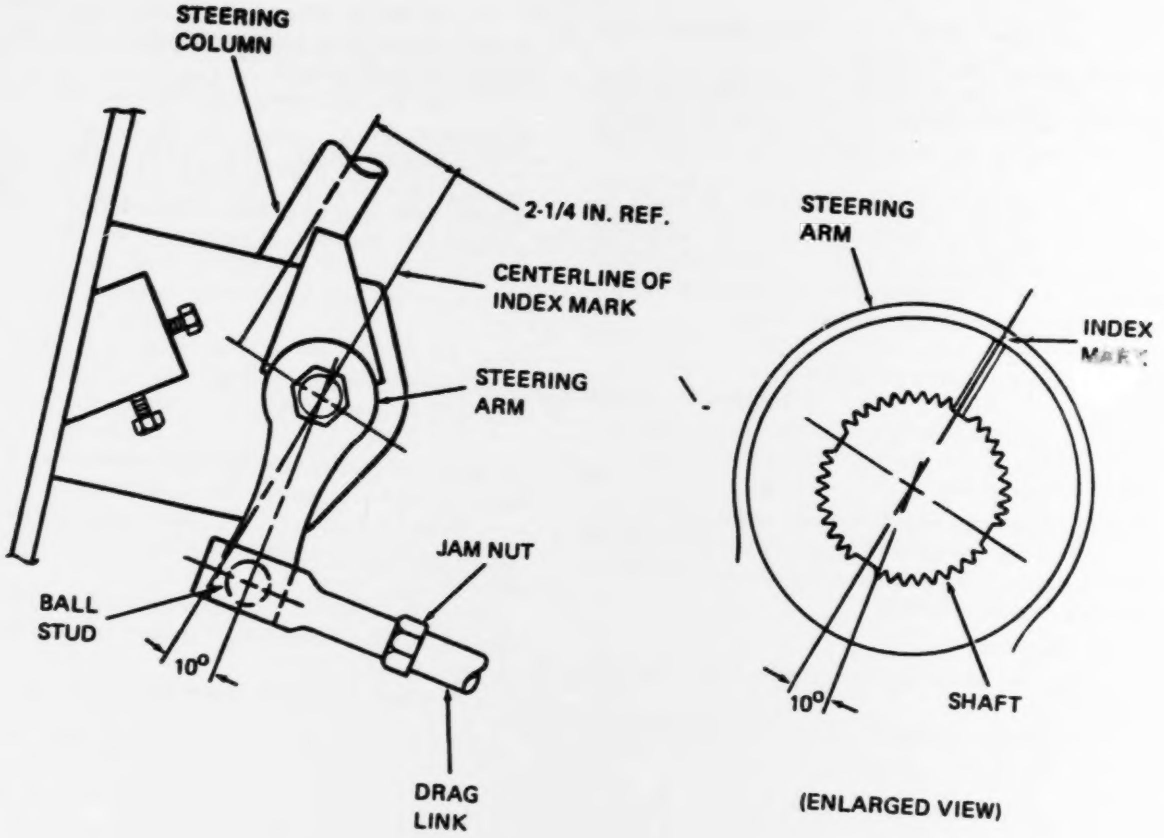
(6) Install steering wheel (TM 10-3930-628-12).

(7) Refill steering gear housing with Lubricant in accordance with current LO.

6-24. Adjustments

a. Drag Link Adjustment.

(1) With steering wheel and rear wheels in straight steer position (TM 10-3930-628-12) attach drag link to steering arm ball stud (fig. 6-10).



ME 3930-628-34/6-10

Figure 6-10. Steering arm installation and drag link adjustment.

(2) With steering arm in position shown on figure 6-10 (center of ball stud 10° from centerline of index mark), adjust drag link to match ball stud position.

(3) Tighten plug in drag link until all end play is removed. Tighten plug one more turn to align cotter pin hole and compress spring. Secure plug with cotter pin.

(4) With drag link attached to ball stud and adjusted to remove end play, tighten drag link jam nut (fig. 6-10) to 90—100 foot-pounds.

b. *Worm Bearing Adjustment.*

(1) Turn steering wheel to end of travel in either direction. To check worm bearing preloading, place a torque gage on the steering shaft and turn steering wheel back approximately one-quarter turn. Torque reading must be ¾—1¼ foot pounds (6¾—11¾ inch-pounds).

(2) Adjust preloading as follows:

(a) Place drain pan under steering gear housing. Drain lubricant.

(b) Remove capscrews (21, fig. 6-9) and oosen cap (22).

(c) If torque reading is greater than that specified, add extra shims (23). If reading is less than that specified, remove shims.

(d) Tighten capscrews (21) to 24—35 foot-pounds.

(e) Refill housing with lubricant, install filler plug. Recheck preload with torque gage. If reading is not within specifications, add or subtract shims one at a time, tightening capscrews and checking reading each time.

c. *Worm and Roller Mesh Adjustment.*

(1) Center the steering wheels and disconnect drag link from steering arm.

(2) Count number of full turns of steering wheel from one extreme to the other. One-half total number of turns is mid-position.

(3) With wheel at mid-position, attach drag link to steering arm.

(4) Place torque gage on steering shaft. Swing wheel one-quarter turn. Torque reading must be 2-3½ foot-pounds (18-31½ inch-pounds).

(5) Adjust worm and roller mesh as follows:

(a) Place drain pan under steering gear housing and drain lubricant.

(b) Loosen adjusting locknut (4, fig. 6-9) and turn adjusting screw (5) clockwise to increase torque reading or counterclockwise to decrease reading.

Caution: Always maintain at least ¾ foot-pounds difference between preload reading (when wheel is only ¼ turn from either extreme) and load reading (when wheel is ¼ turn either direction from midposition).

(c) When adjustment is correct, hold adjusting screw (5) in place and tighten lock nut (4) to 20—25 foot-pounds.

(d) Refill housing with lubricant and install filler plug.

d. Steering Arm and Axle Stop Adjustment. Refer to TM 10-3930-628-12 and adjust steering arm and axle stops. Install floor and toe plates (TM 10-3930-628-12).

Section V. STEERING CONNECTION

6-25. Description

The steering drag link assembly connects the arm on the steering gear to the pivot bracket on the rear steering axle. The link assembly is adjustable for steering system operation.

6-26. Removal

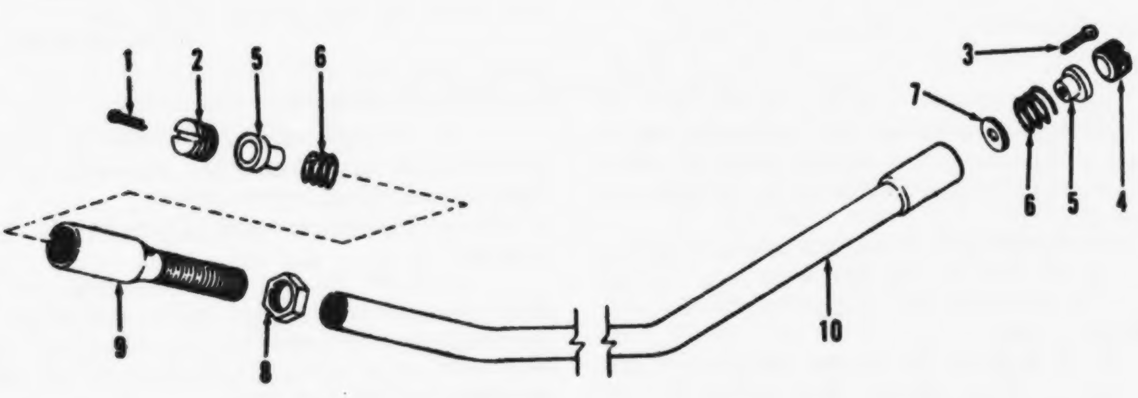
a. Remove floor and toe plates (TM 10-3930-628-12).

b. Raise rear of truck with a chain hoist enough to make rear end of drag link accessible. Block front wheels and under frame securely.

c. Remove cotter pin (1, fig. 6-11) and loosen adjusting plug (2) to disconnect drag link end from steering gear arm.

d. Remove cotter pin (3) and loosen adjusting plug (4) to disconnect drag link from pivot arm ball on rear axle.

e. Remove drag link assembly from truck.



ME 3930-628-34/6-11

1. Cotter pin
2. Adjusting plug
3. Cotter pin
4. Adjusting plug
5. Ball seat
6. Spring
7. Washer
8. Jam nut
9. Socket
10. Link

Figure 6-11. Drag link assembly, exploded view.

6-27. Disassembly

a. Remove adjusting plugs (2 and 4).

b. Remove ball seats (5), springs (6) and washer (7).

c. Scratch mark on socket (9) for position. Loosen jam nut (8) and remove socket (9) and nut.

6-28. Cleaning, Inspection and Replacement.

a. Clean all parts with cleaning compound, solvent (Fed. Spec. P-D-680). Cleaning may be done during disassembly and parts set to dry on clean paper towel.

b. Inspect parts to be sure they have not been severely scored or damaged by dirt particles. Clean slightly scored parts by hand rubbing with 600-grit abrasive paper.

c. Prepare parts for reassembly by coating with grease (GAA).

6-29. Assembly

Refer to figure 6-11 and assemble the drag link assembly in reverse order of disassembly.

6-30. Installation

a. Align socket end of drag link assembly with ball on steering unit arm and install. Tighten adjusting plug to retain it.

b. Install rear end of drag link on ball on rear axle pivot arm. Tighten adjusting plugs (2 and 4, fig. 6-11) until all end play is removed. Continue tightening about one more turn to align cotter pin holes and compress spring. Secure plugs with cotter pins (1 and 3).

6-31. Adjustment

a. Adjust drag link and steering arm as detailed in paragraph 6-24.

b. Install new cotter pins in adjusting plug holes.

c. Lubricate drag link fittings (LO 10-3930-628-12).

d. Install toe and floor plates. Remove blocks and lower rear of truck to floor.

CHAPTER 7

FRAME AND COMPONENTS

Section I. GENERAL

7-1. General

a. This chapter covers repair of the truck frame and components. The frame forms the base for the truck. All parts are attached to or supported by the welded frame.

b. Repair of the parking brake linkage and the seat are also contained in this chapter. The seat actuates the parking brake and switch. To operate the truck the seat must be depressed to release the brake and close the switch.

7-2. Description

a. Frame. The frame is of welded steel construction. The front is adaptable to connect the mast and has cutouts to allow function of the tilt cylinders. A slanted upright section at the front supports the instrument panel and directional control. Floor and toe plates with cutout sections cover the service brake and accelerator linkages. The accelerator is mounted on the toe plate, with the accelerator rod extending from the linkage through a slot in the toe plate.

b. Mountings. The rear of the frame is recessed to provide a large compartment for the battery. A counterweight is secured to the rear plate of the compartment and the truck frame. Mounting for the power switch is provided in a box-like opening in the lower left side of the frame. Sintered metal filters allow air to enter the compartment for cooling but effectively keep any dirt or debris from entering. An upright rear wall of the operator's compartment serves as a support for the contactor box, parking brake linkage, operators seat and control valve. A welded steel slanted front portion of the frame supports the instrument panel and steering column.

Section II. FRAME AND COMPONENTS

7-3. Removal and Disassembly

a. Refer to the previous chapters of the book to remove components.

b. Refer to figure 7-1 to remove sheet metal parts and frame parts for repair as necessary.

7-4. Cleaning

a. Clean all parts in cleaning compound, solvent (Fed. Spec. P-D-680) and dry thoroughly with compressed air.

b. Clean acid tray with a solution of baking soda and water. Flush clean with fresh water.

7-5. Inspection and Repair

a. Straighten bent sheet metal if possible. Check for elongated screw holes and cracked areas.

b. Inspect frame for cracks, broken welds and other damage. Repair welds.

c. Inspect hinges on battery cover for proper operaton.

d. Check sintered metal filters for cracks, chipped areas or other damage. Replace damaged filters.

7-6. Installation

a. Refer to figure 7-1 and install parts as necessary.

b. Refer to previous chapters to install truck components.

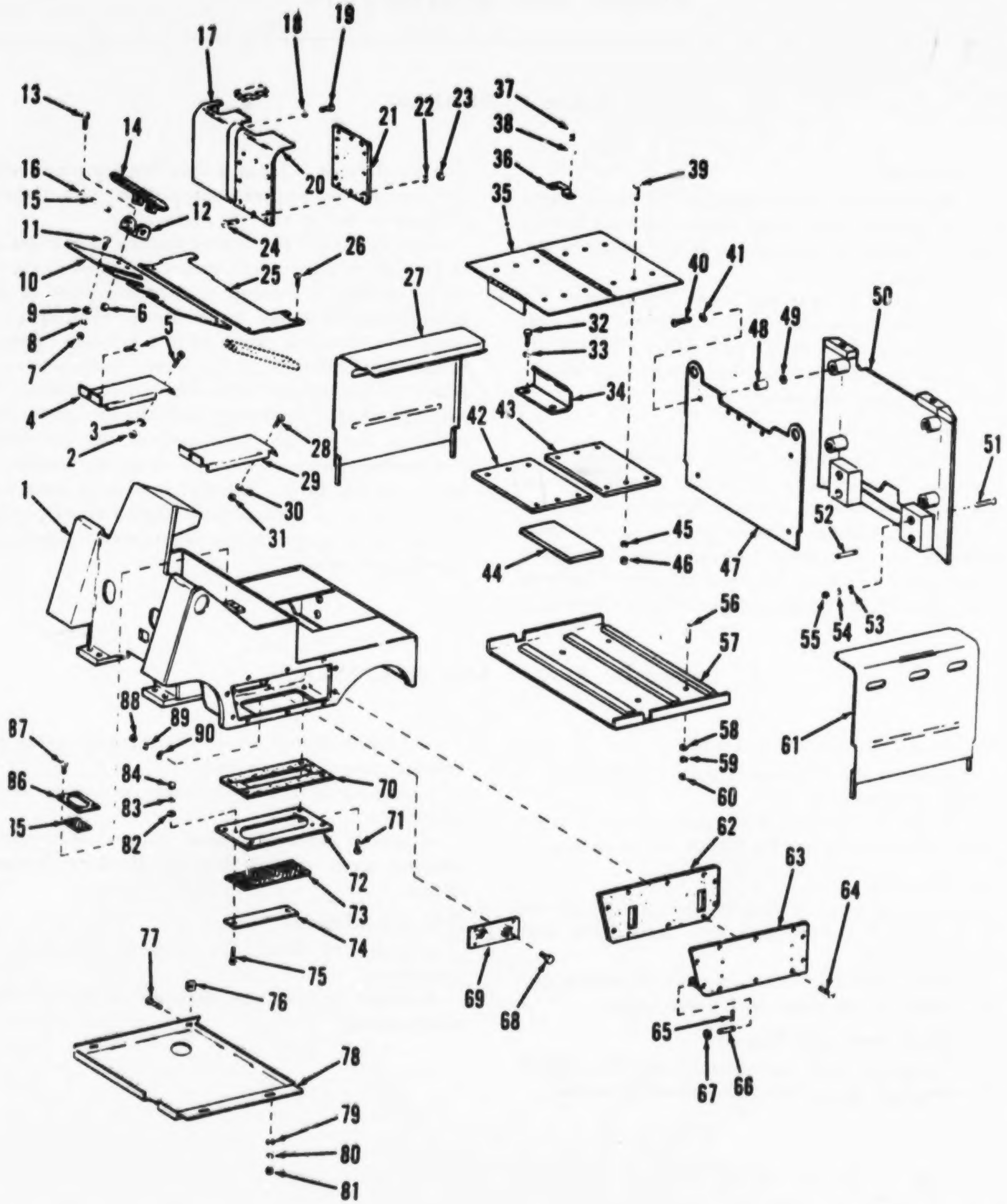


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Figure 7-1. Frame and components, exploded view.

KEY to fig. 7-1:

1. Frame
2. Nut
3. Washer
4. Control board cover
5. Screw
6. Nut
7. Nut
8. Washer
9. Washer
10. Toe plate
11. Screw
12. Accelerator bracket
13. Screw
14. Accelerator
15. Pivot pin
16. Retaining ring
17. Valve cover
18. Washer
19. Screw
20. Contactor box cover
21. Gasket
22. Washer
23. Nut
24. Screw
25. Floor plate
26. Screw
27. Side panel
28. Screw
29. Diode cover
30. Washer
31. Nut
32. Screw
33. Washer
34. Battery retainer
35. Battery cover
36. Handle
37. Screw
38. Washer
39. Screw
40. Screw
41. Washer
42. Insulation
43. Insulation
44. Insulation
45. Washer
46. Nut
47. Rear plate
48. Spacer
49. Washer
50. Counterweight
51. Screw
52. Pin
53. Washer
54. Washer
55. Nut
56. Screw
57. Acid tray
58. Washer
59. Washer
60. Nut
61. Side panel
62. Gasket
63. Power switch cover
64. Screw
65. Cotter pin
66. Hinge pin
67. Washer
68. Screw
69. Filter
70. Gasket
71. Screw
72. Bottom plate
73. Filter
74. Strap
75. Screw
76. Nut
77. Screw
78. Drip pan
79. Washer
80. Washer
81. Nut
82. Washer
83. Washer
84. Nut
85. Filter
86. Cover
87. Screw
88. Nut
89. Washer
90. Washer

Section III. PARKING BRAKE LINKAGE

7-7. General

a. The parking brake linkage is actuated by the hinged operating seat. Weight of the operator lowers the seat, disengages the parking brake and closes the seat switch. The seat must be occupied and switch closed before truck circuits are operative.

b. A heavy spring, secured to the lower part of the linkage beneath the drive motor bracket, applies the brake when pressure is removed from the seat.

7-8. Removal

a. Refer to TM 10-3930-628-12 to remove the linkage and seat.

b. Refer to figure 7-2 for removal of remaining linkage and components.

7-9. Inspection and Repair

a. Inspect threaded rods for damaged threads, bent condition and other damage.

b. Inspect switch actuator for wear and damage.

c. Inspect spring for cracks, weak coils, and damage.

d. Inspect switch for proper operation and damage.

e. Repair parts if possible. Replace unserviceable parts.

7-10. Installation

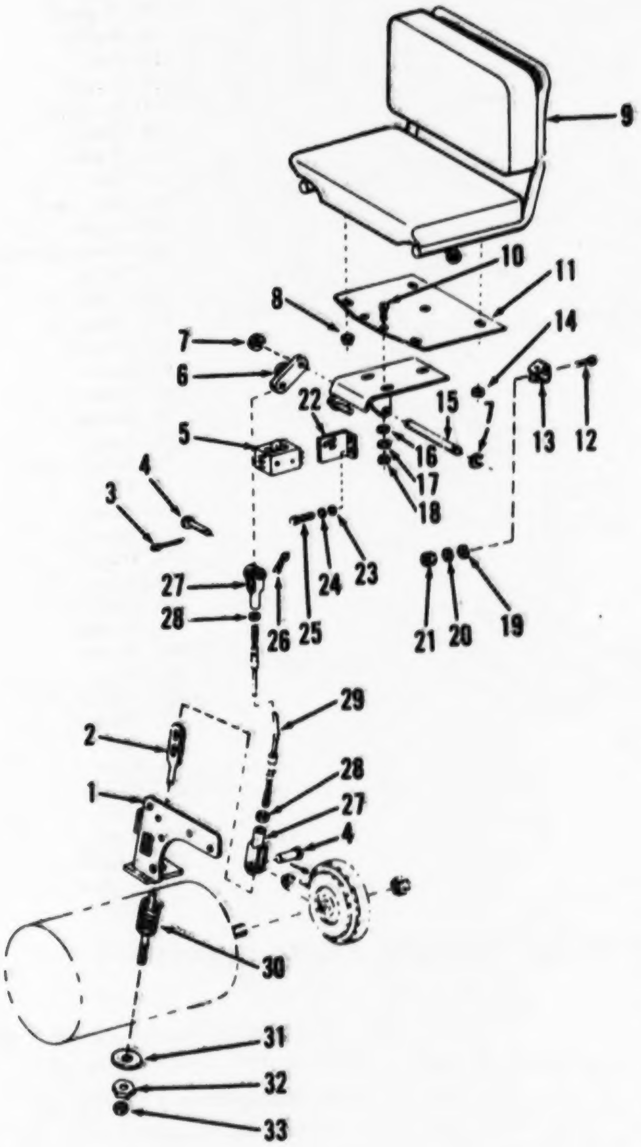
a. Refer to figure 7-2 and install linkage components.

b. Refer to TM 10-3930-628-12 and install seat and linkage.

7-11. Adjustment

a. Refer to TM 10-3930-628-12 to adjust parking brake linkage.

b. Refer to TM 10-3930-628-12 to adjust switch operation. Check operation of switch to insure proper control and truck movement.



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1. Drive motor bracket
2. Lower rod
3. Cotter pin
4. Yoke pin
5. Seat switch
6. Switch actuator
7. Retaining ring
8. Seat bumper
9. Seat assembly
10. Screw
11. Seat plate
12. Screw
13. Seat latch
14. Flange nut
15. Shaft
16. Washer
17. Washer
18. Nut
19. Washer
20. Washer
21. Nut
22. Switch bracket
23. Washer
24. Washer
25. Screw
26. Cotter pin
27. Yoke
28. Nut
29. Linkage rod
30. Spring
31. Washer
32. Spring
33. Nut

Figure 7-2. Parking brake linkage, exploded view.

Section IV. OPERATOR'S SEAT

7-12. General

a. The operator's seat is mounted on a hinged plate (fig. 7-2). Occupation of the seat lowers the seat and the hinge pivots, releasing the parking brake and closing the switch.

b. Slides attached to the seat frame allow the operator to position the seat for comfortable operation. Cushions on the seat and backrest help the comfort of the operator.

7-13. Removal

a. Refer to TM 10-3930-628-12 and figure 7-2 to remove the seat assembly.

b. Disconnect and remove the stop and taillight before removing seat.

7-14. Disassembly

a. Refer to figure 7-3 and disassemble the seat assembly.

b. Disconnect spring (9) from seat latch.

7-15. Inspection and Repair

a. Inspect cushions for tears in covering, loose mounting brackets, and other damage. Repair minor tears with tape if possible.

b. Inspect slides for bent or damaged condition. Move slide back and forth to check operation. Check spring for cracks and damage.

c. Inspect frame for bending and warped condition. Inspect welds for security. Straighten seat frame if possible. Repair welds.

d. Replace all unserviceable parts.

7-16. Assembly

a. Attach spring (9, fig. 7-3) securely to slide and latch.

b. Refer to figure 7-3 and assemble seat.

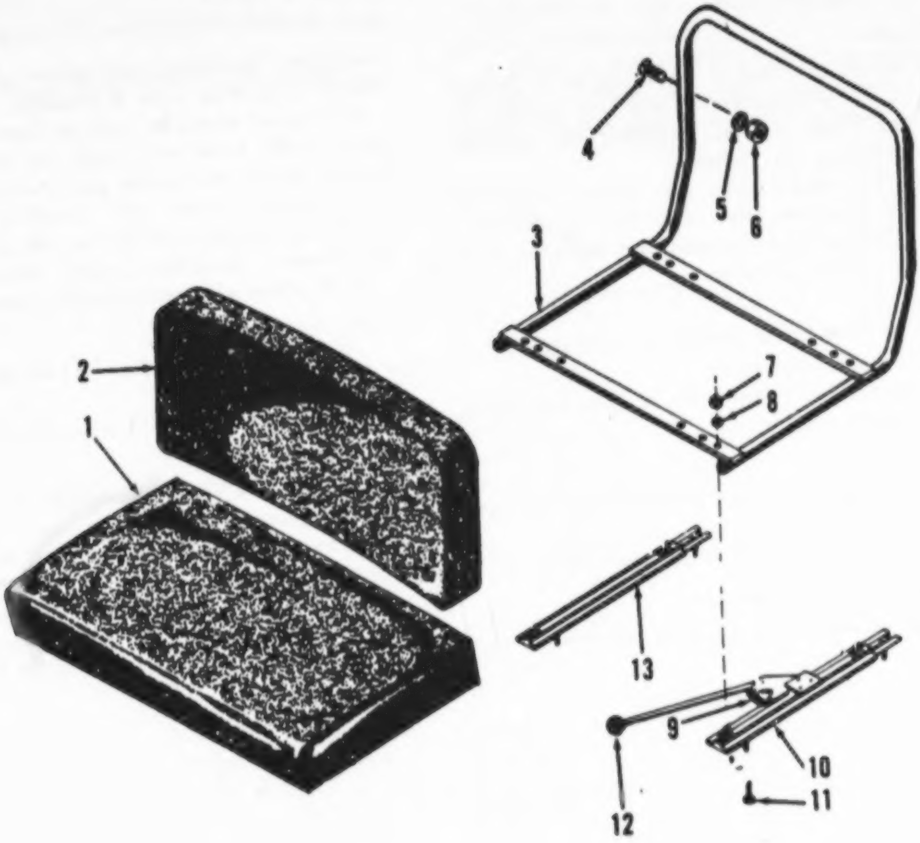
7-17. Installation

a. Refer to TM 10-3930-628-12 and figure 7-2 and install seat assembly.

b. Install and connect stop and taillight to rear of backrest.

c. Check slide and lock for proper operation.

d. Check operation of parking brake and seat switch. Adjust if necessary (TM 10-3930-628-12).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1. Seat cushion
2. Backrest
3. Seat frame
4. Screw
5. Washer
6. Nut
7. Nut
8. Washer
9. Latch spring
10. Left hand slide
11. Screw
12. Ball
13. Right hand slide

Figure 7-3. Seat assembly, exploded view.

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REFERENCES

A-1. Fire Protection	
TB 5-4200-200-10	Hand Portable Fire Extinguishers Approved For Army Users
A-2. Lubrication	
C9100-IL	Fuels, Lubricants, Oils and Waxes
LO 10-3930-628-12	Lubrication Order
A-3. Painting	
TM 9-213	Painting Instructions for Field Use
A-4. Radio Suppression	
TM 11-483	Radio Interference Suppression
A-5. Maintenance	
TM 38-750	Army Maintenance Management System (TAMMS)
TM 9-6140-200-15	Operation and Organizational Field and Depot Maintenance Storage Batteries, Lead Acid Type
TM 10-3930-628-12	Operator and Organizational Maintenance Manual
TM 10-3930-628-20P	Organizational Maintenance Repair Parts and Special Tools List
TM 10-3930-628-34P	DS and GS Maintenance Repair Parts and Special Tools List
Fed Spec. P-D-680	Dry Cleaning Solvent
A-6. Shipment and Storage	
TB 740-93-2	Preservation of USAMEC Mechanical Equipment for Shipment and Storage
TM 740-90-1	Administrative Storage of Equipment
A-7. Destruction of Army Material to Prevent Enemy Use	
TM 750-244-3	Procedures for Destruction of Equipment to Prevent Enemy Use

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